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GRAVES' DISEASE AND ITS TREATMENT.

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There is no disease which shows so many signs of a universally acting toxemia as Graves' disease. Not a physiological function of the body escapes being characteristically disordered by it at some time or other during its chronic course. It is pertinent, therefore, at the outset of its consideration to ask what disease, toxic or otherwise, that can be named, approaches it in this respect? Thus the functional nervous symptoms include great nervousness; mental disturbances ranging from depression, aboulia, and changes of disposition to actual mania; distressing tinnitus which may end in complete deafness, to disappear, however, with recovery from the disease; all varieties of functional disorder of the eyes; affections of smell and of taste; pains general or peculiarly located, or limited to certain groups of muscles; headaches; vertigo; various parasthesiæ; local motor paralyses; bulimia; insomnia; and pruritus. The vascular symptoms include palpitation, enlargement and throbbing of the arteries, both general and local vasomotor paralyses, and the characteristic tachycardia. The muscular symptoms are tremors, either general or particularly local, general muscular debility, local weakness of the knees, weakness or spasm of the laryngeal muscles, cramp of the calves, abasia, etc. Disorders of nutrition appear in extreme emaciation with marked loss of bulk in muscles and in bones, loss of hair, and pigmentation. The glandular de-

rangements show themselves by thyroid enlargement with exophthalmos, by severe and characteristic disorder of the gastric and intestinal secretions, and by sweating, not to mention irritability of the urinary bladder, with or without polyuria.

Every one of these derangements can be extreme in degree in individual cases, but however grave or even fatal some of them may be, yet they have one important feature in common, namely, that no organic change accompanies any one of them. In any other disease such severe symptoms would be sure to be due to, or sooner or later be accompanied by, either inflammatory or degenerative textural alterations; but not so in Graves' disease. The tachycardia, although marked and prolonged for years, is not caused by nor associated with carditis in any form, nor does the heart show any kind of degeneration different from the nutrition changes in other muscular tissues. In Graves' disease death often follows upon uncontrollable vomiting and diarrhœa, but autopsies of these cases reveal not a sign of gastritis or enteritis. No visible changes from the normal are found in the eyes nor in the ears, however seriously disordered functionally they may have been. Likewise the great irritability of the bladder has no cystitis to explain it, nor is the itching accompanied by any cutaneous eruption.

This proves that one and the same agent produces all the effects. Graves' disease, therefore, is one, and being so it cannot be confounded with anything else—an important fact to bear in mind when we find it with the name goitre attached to it; because most goitres have nothing to do with Graves' disease and produce none of its symptoms, nor, as we shall see, are other tissue changes in the thyroid, lately alleged to be distinctive of this complaint, really so, because they may be found on dissection without any preceding or accompanying signs of Graves' disease. On the other hand, nothing can be more certain than the diagnosis of Graves' disease itself, since no other malady has so many characteristic signs. The absence of some of them, such as exophthalmos or an appreciable enlargement of the thyroid, is more than made up by the presence it may be of twenty other symptoms which are thus particularly grouped only in this malady. Therefore, the only deduction possible is that the complaint is due to a specific poison which goes wherever the blood goes and which causes no more tissue changes, except, indirectly, on nutrition, than does opium or aconite.

What the nature and origin of this poison is remains wholly unknown. More than half a century ago, Dalton in the preface to his *Physiology* congratulated the profession on the prospect that Claude Bernard's recent discovery of the sugar-making function of the liver would soon reveal the cause of diabetes. At present the explanation of diabetes is not yet in sight. So, in 1902, Kocher printed a bibliography of 1400 books, treatises, and articles on Graves' disease, and since that time the list may be extended to

2500. But all the experimental research and clinical observation, to which this voluminous literature testifies, have served only to illustrate the manifold uncertainties connected with the subject itself, and where uncertainity abounds theories proliferate.

The chief cause of this uncertainity is that as correct physiology is an essential prerequisite to correct pathology, we are yet at sea as regards the physiology of the thyroid and its associated structures. Unlike the adrenals, the active principle of whose internal secretion has been isolated and even may be artificially constructed, no one knows what the internal secretion of the thyroid is. Undoubtedly one of its physiological uses is to prevent the myxœdema which supervenes upon atrophy or upon ablation of the gland, and which otherwise fatal disorder can be relieved by administration of thyroid extracts. But the inference of an indispensable function of the thyroid on this account is considerably modified by the fact that while this gland, like the thymus, is a temporary organ and goes out of commission after fifty years of age, myxœdema does not then follow either upon its atrophy or upon its surgical removal. Hale White,[1] Kocher,[2] and others have shown that as age advances the thyroid degenerates, and in old subjects the normal glandular structure can with difficulty be recognized. In dogs, if they are old, thyroidectomy is neither fatal nor accompanied by the usual symptoms. Kocher points out that postoperative myxœdema scarcely occurs at all in elderly people.

Bourneville and Bricon[3] put the limit to postoperative myxœdema as early as the thirtieth year. The thyroid, therefore, is needed for an ill-understood purpose connected with the age of the body, apparently corresponding with the duration of the reproductive functions, and which may have to do with the susceptibility of women, to Graves' disease, the ratio in my experience being 9 to 1 in men. But if Graves' disease is primarily a thyroid disease, especially if it be due, as supposed by many, to hypersecretion of the thyroid gland, how can we explain severe and even fatal cases of Graves' disease in elderly patients who seem to have no thyroid left? I treated a lady who, in the course of three years, had become dangerously reduced with exophthalmic goitre. After a year's treatment she apparently wholly recovered, having increased in weight from 81 pounds to 142 pounds, with disappearance of both the goitre and the exophthalmos, but three years subsequently she relapsed and died in her sixty-third year with all the symptoms of her original complaint, except that the thyroid seemed to be wholly atrophied and could not be felt. Another lady recovered for five years from the severest symptoms of Graves' disease, and then relapsed and died when she was sixty-five years old without a sign of goitre.

[1] Lancet, 1888, i, 521.
[2] Arch. f. klin. Chir., 1883, xxix.
[3] Arch. de neurol., 1886.

On the other hand, much the commonest and most pronounced goitres have no connection or relationship with Graves' disease. This gland is very sensitive to certain as yet unidentified stimuli in drinking water which excite it to great overaction with consequent hypertrophy. Lombroso mentions a well in Lombardy whose water produces goitre in fifteen days, and is resorted to on that account by young men who thereby aim to escape military service. But how this gland may have its cells stimulated into such activity without developing from beginning to end a single one of the twenty-six peculiar symptoms of Graves' disease, is a question to which none of the advocates of undue "thyroidism" give a satisfactory answer. Moreover, all authorities concur in stating that Graves' disease is no more prevalent in localities where parenchymatous goitre is endemic than it is elsewhere.

In recent years the problem has been further much complicated by the inclusion of the parathyroids in its consideration. By some (Gley,[4] Vessale and Generale,[5] MacCallum[6] and others) the function of the parathyroids is regarded quite as essential to life as that of the thyroid itself, and hence all former discussions on Graves' disease in which the thyroid only was considered are deemed seriously defective. In rabbits the parathyroids are not embedded in the thyroids, and Gley's explanation why thyroidectomy seemed to cause so little effect in those animals was that the removal of that gland did not remove the parathyroids with it, but when he excised the parathyroids the full fatal train of nervous symptoms developed, though the thyroid was left intact. MacCallum's parathyroidectomies in dogs supported the same inference of the tetany, etc., being the result of the absence of the secretion of these glands. But other experimenters contradict their statements. Vincent and Jolly[7] in their recent reports deny that removal of the parathyroids has any effect in rats, guinea-pigs, and badgers, and state that monkeys showed only transient nervous symptoms after the operation, while nervous symptoms sometimes developed although these glands were left in situ.

But meantime if the parathyroids are all which is claimed for them the question still remains unsettled as to how much of the symptom-complex of Graves' disease can be attributed to hypo- or to hyper-secretion of these little bodies or to total absence of their secretion owing to their entire disappearance, as this has been reported in examinations both of the thyroids of fatal cases and in thyroids removed by surgical operations.

Another of the many anomalies of this complaint is the superven-tion after surgical operations on the thyroid of two very serious conditions which are quite distinct in their nature from each other,

[4] Compt.-rend. Soc. de biol., 1891.
[5] Arch. Ach. ital de Biol., 1895.
[6] Trans. Assoc. Amer. Phys., xviii, 35.
[7] Jour. Physiology, 1905, xxxi; 1906, xxiv.

although often confounded together. The first, which is almost uniformly fatal, is the development in the course of some hours after operation of rapidly increasing hyperpyexia rising from 103° F.. to 108° F. or 110° F., with great dyspnœa, extreme tachycardia, pulmonary œdema, coma, and death. Formerly this was called "acute thyroidism" and ascribed to sudden absorption of thyroid secretion from vessels and surfaces cut in the operation, or to undue handling of the gland, dislodging quantities of the secretion into the circulation. But it would be difficult to bring together so many pure assumptions as this view does or where theory and facts are so wide apart. That the thyroid should contain a powerful thermic poison at any time is rendered improbable by the clinical fact that the most fatal effects of the toxemia of Graves' disease continue to the last in keeping with all its other manifestations, in that no fever accompanies them. Graves' disease is preëminently a non-febrile complaint. In the second place this same fatal condition takes place after operations for Graves' disease in which the thyroid has not been cut into at all, and when every precaution was taken not to disturb it. R. F. Curtis,[8] alarmed by three deaths from "acute thyroidism" out of 11 thyroidectomies performed by him, tried instead the operation of sympathectomy in 7 patients, and although in operating he carefully avioded either wounding or handling the thyroid, 2 out of the 7 died from this imaginary thyroidism.

A more probable explanation of this condition, so indicative of profound bulbar disturbances from the heat centre to the cardio-respiratory centres, is furnished by the intimate relations of the cervical sympathetic and of the thyroid itself to the medulla, section of the restiform bodies producing permanent exophthalmos. In fact it is dangerous to disturb the bulbar centres with any afferent excitation wholly new to them. Over 40 deaths with all the hyperpyexia and other symptoms of alleged acute thyroidism have been published as following upon washing out the pleura, and several from washing out the stomach, one of which, in the Addenbrook Hospital, London, was exactly parallel in onset and course with those following thyroidectomy.

The other condition has been called postoperative tetany, and although occasionally fatal, in some cases becomes chronic with symptoms characteristic of the disorder long known under the name tetany. This affection is itself obscure enough on account of its developing in the course of so many widely different diseases. It occurs in a variety of infections including malaria, but especially in gastro-intestinal disturbances, in teething infants, in nursing women, in Bright's disease, etc. But when the fact is added that its prevalence may be both endemic or epidemic, discussion of its etiology ceases to be practicable. Nevertheless the symptoms attending its

[8] Trans. Amer. Surg. Assoc., 1903.

development after operations on the neck are so similar to those following experimental parathyroidectomy that a good case may be made out for ascribing it then to trauma of those glandules or to interference with their blood supply. Halsted's[9] postoperative case, which in time was greatly improved by the administration of the parathyroids of beeves, strongly supports this view. Meanwhile, R. L. Thompson[10] in his exhaustive paper on *Atrophy of the Parathyroid Glandules in Primary Infantile Atrophy*, remarks that he never met with tetany in such infants and that the histological investigation of these glandules is in general negative in cases which had tetany in life, the records as usual being very contradictory, so that the fact is by no means proved that in the human subject destruction of these bodies always produces tetany.

The very latest pronouncement on this subject is by Dr. David Forsyth,[11] who by grants from the Royal Society and from the Science Committee of the British Medical Association, was enabled to make the most extensive experimental researches on parathyroids in all kinds of mammalia, as well as in birds. He expresses as his final conclusions the opinion that the parathyroids are glands not necessary to life and are essentially thyroidal in nature and possess no peculiar function.

Recently much interest has been awakened by the reports of Beebe and John Rogers of the successful treatment of Graves' disease by hypodermic injections of an antitoxin prepared from thyroids of cases of exophthalmic goitre. There can be no question of the apparently beneficial, if not the curative, effects of this new method of treatment in some cases, but its explanation is another matter. I can conceive that the specific poison of Graves' disease may be especially accumulated in the substance of the hypertrophied gland so that from it an antitoxin can be manufactured after the usual methods. This serum treatment, however, failed in two cases of my own although faithfully administered, by one of its discoverers for several weeks to the first patient, and similar failures have been reported by others. This, however, is only in keeping with other "cures" of Graves' disease, early enthusiasm subsiding with more experience.

But the most serious objection to the view that Graves' disease is primarily due to hypersecretion by the thyroid lies in the occurrence of numerous cases of Graves' disease, some of them fatal, in which there was no goitre or exophthalmos at any time in their history. It is begging the question to call such cases non-typical, *fruste*, or abortive when they show all the typical symptoms of the malady except goitre and exophthalmos, and equally so is it to term them latent or incomplete when the disease runs its course to a fatal

[9] Amer. Jour. Med. Sci., July and October, 1907.
[10] Ibid., October, 1907.
[11] Quarterly Jour. Medicine, January, 1908.

issue in as large a proportion with them as in those with goitre. In my monograph on *Graves' Disease With or Without Goitre*[12] I give the detailed histories of 68 patients: 41 with goitre and 27 without, with a careful comparison of the percentage of each symptom in the two classes, sufficient to demonstrate that there could be no mistake in the diagnosis of the cases without goitre as nevertheless undoubted examples of Graves' disease. In this list there were 2 deaths among those with goitre, and 2 also in the lesser number without goitre. Not one of these 68 patients was a hospital case, because though I have had many such, yet their stay in hospitals is too short to make observations on them satisfactory, particularly as to the effects of any measures for treatment, medical or surgical. I have had 4 patients who seemed perfectly recovered from the disease, in 3 of them for periods of three, four, and five years, and then die from a relapse of the original complaint. The fourth who had not consulted me for nearly seven years because he said that at no time had he been ill, then relapsed and came very near dying, although he has since measurably recovered. Everyone of those patients had resumed a meat diet.

Since the publication of that monograph, I have had a number of other cases of both classes, in private and in consultation practice, and I now regard those without goitre as on the whole the more difficult to treat. One lady without any goitre, whose mother died from Graves' disease, has been continuously under my observation for eighteen years with severe recurrences of Graves' disease whenever she takes meat. She had a sister who presented the same symptoms without goitre for five years and then developed a pronounced goitre just as she was getting well. She was very confortable with her goitre for six months, after which it wholly disappeared. Two years afterward she succumbed to cancer of the breast. Graves' disease goitre is very changeable in its size without any reference to the other symptoms, so that I pay but little attention to it.

Prof. Barker,[13] however, is seemingly so convinced that Graves' disease is necessarily a thyroid disease, that if we do not find a goitre there must be something of the kind nevertheless, and that faulty examination is responsible for the failure to find these virulently poisonous masses. He admits, however, that he has had three cases in his hospital wards in whom no such growth was palpable. But to me his views seem influenced by the observations of MacCallum and Halsted of a definite kind of alteration in thyroid tissue in Graves' disease, the anatomical details of which may be found in MacCallum's paper.[14] These changes may involve the whole gland or be limited to certain foci, when, of course, clinicians may be wholly ignorant of them and of their significance. I can only

[12] William Wood & Co., New York, 1904.
[13] Jour. Amer. Med. Assoc., October 12, 1907.
[14] Ibid., October 5, 1907.

say that clinicians would welcome any anatomical proofs of Graves' disease and long have been waiting for them. But when Dr. MacCallum adds that these same textural appearances, general and local, may be found in the thyroids of sheep, goats, and particularly in stray dogs, and Dr. A. Kocher[15] says in human thyroids also, without any of the symptoms of Graves' disease accompanying them, these anatomical peculiarities may really have no more causative relationship to Graves' disease than the goitres produced by the waters of Lombroso's wells. Graves' disease without general indistinction from local symptoms does not exist, and as to foci I do not believe that a single focus remained in the atrophied thyroids of the two old ladies above mentioned, who died with all the symptoms of Graves' disease and of no other disease.

I was early led to question the view that this malady is caused exclusively hy hypersecretion of thyroid juice, because like Pompey's Pillar at Alexandria this theory is so striking by its solitariness. If true it would tower over the whole field of medicine quite alone. We are all acquainted with hypersecretion by glands, but never without our being able to account for this behavior of theirs either by the presence in the blood of something which excites them, or less frequently by some nervous irritation. Salivation, however common, is never due to the parotids spontaneously flowing. As to a nervous irritation causing a serious morbid process persisting unchanged it may be for years, this, as Fagge well remarks, is a phenomenon wholly unknown in pathology. There is no limiting theorizing when the nervous system is brought in, as when Hector Mackenzie ascribes Graves' disease invariably to fright, so that although the patient cannot remember the fright some ancestor of hers may once have been badly scared and thus started the process. Hence I pay little credence either to the view that Graves' disease comes from the cervical sympathetic or that the thyroid secretes its poison just as it were, from its own innate depravity. If the thyroid does secrete uncommonly, something not of the thyroid must make it do so. This doubt, however, by no means excludes the supposition that when once Graves' disease is established by its own primary cause, conditions of the thyroid and of the sympathetic may materially affect its course.

My own views of the pathology, and, therefore, of the treatment of Graves' disease, are based upon therapeutics. Clinical observations are as good as laboratory experiments, provided that in making them the same care is taken against fallacies in observation and in deduction. This cannot be done without writing down the observations every time they are made, through years if necessary. Only private, in distinction from hospital, patients, for reasons already stated, will afford the necessary data for conclusive demonstration.

[15] Jour. Amer. Med. Assoc., October 12, 1907.

My final verdict is that proper medical treatment furnishes the best chances for recovery from the disease in *severe* cases, and, of course, therefore, in the milder forms. If I could have the complete control of the management of the patient I would prefer one who has been brought too low by the disease for the surgeon to venture to propose operation. The histories of several such are detailed in my book. Incipient or mild cases too often improve spontaneously to be at all conclusive. The one condition when I would have but little hope is when uncontrollable vomiting and diarrhœa have supervened in a patient already far gone. As the best cure for indigestion is digestion the only recourse then is to find some form of food which will stay down although only in very small doses. At no time in the course of Graves' disease can its diarrhœa be checked by opiates or by astringents.

As to pathology, my first surmise of it was suggested by the case of a lady who came to me with exophthalmic goitre twenty-seven years ago, much reduced in flesh and strength. In addition to medical prescriptions which I now regard as useless, although found then in the text-books, I enjoined her restriction to the Asiatic fermented milk preparations, which I was the first to introduce to this country, but which are quite generally used now under the names of kumyss, matzoon, zoolak, etc. She immediately began to improve in every respect, and after six months felt so well that she ceased her visits. In three months more I was called to see her again prostrated with her old symptoms. Again she was put on the milk and again she thought she had recovered. At the end of another summer I was hastily summoned to her bedside only to feel her pulse stop forever while I had my finger on it. I was told by her family that in spite of their protests she began to eat meat heartily, saying that she would rather die than take the milk. Similar injury to patients with this disease from indulgence in butcher meat has been duplicated in my experience ever since. I would as soon recommend confirmed diabetics to take all the starchy food they please, as to advise the Graves' people to relieve their weakness with that strengthening article, roast beef.

Here it begins to look like discerning the same relations of Graves' disease to the nitrogenous elements of food that diabetes has to the starchy elements, in other words we find our therapeutic guide (diet) leading us directly into the great forest of metabolism where all paths are soon lost in the thick undergrowths of theory. But what we do know is that in diabetes, if the system cannot get any carbohydrates it will split up its proteins into sugar with fatal results, and hence in Graves' disease our proper dieting must somehow provide nitrogen the best way it can, and for that we will give a diet list accordingly. But how about those glands in the neck? Some say that if the parathyroids are removed a virulent poison soon destroys the dogs unless they are freely bled and a compensatory amount of normal saline is infused,

when they will live for twenty-four hours until this same poison has accumulated enough to necessitate a repetition of the infusion. Or the dogs may be kept longer alive if they are fed on bread and water. Give them meat and it quickly kills them. The plain deduction is that a poison coming from somewhere is normally neutralized by the parathyroids, and the effect of diet points to the alimentary canal as the source of the poison. The steps between the food taken and the parathyroids belong to the yet hidden secrets of metabolism, and so also do the other problems of Graves' disease, for the whole symptom-complex of this malady cannot be explained by the parathyroids. One other poison at least must be accounted for, whose property is to paralyze the vasoconstrictors everywhere, and by dilating all arterioles cause the tachycardia and many of the other symptoms of the disease. This poison, therefore, is the opposite of adrenalin in its effects.

But we are now again landed in the thickets of theories. One theory has long held the field, namely, that whereas the parathyroids neutralize a poison the larger gland produces one, or what is virtually so by its own proper secretion being improperly increased. Oswald, however, insists that instead of its own secretion being increased it is decreased. However, not to prolong an article already suggestive of why there are 2500 other writings on this subject, we will call in our therapeutics to supply a theory based on a solid fact to begin with, which is that by proper diet Graves' disease generally subsides as commonly as glycosuria after middle life disappears by its proper diet. In addition to this some of its most intractable symptoms promptly yield to medicines which affect the intestines. Repeatedly I have brought down the pulse forty beats by one blue pill, which certainly cannot slow the pulse in the same way that veratrum viride does, because neither veratrum nor any other cardiac sedative controls this tachycardia. Hence it may be that a poison generated in the alimentary canal normally finds in the thyroid what the other poison finds in the parathyroids, that is, a gland which can neutralize it. Excessive amounts of this poison in the blood excite the thyroid into overaction and thus often, not always, lead to its hypertrophy. The goitre, therefore, is secondary to a blood condition, just as hypertrophy of the spleen is, and to get rid of it and of all its other accompaniments we must attend to the intestine.

All theories, however, that I know of about Graves' disease have one failure in common, viz., that no one of them explains all the facts, and mine outlined above is no exception. How a toxemia originating in the alimentary canal can be cured by a surgical operation not on the alimentary canal but on the thyroid, is not very clear. That Graves' disease has been successfully relieved or cured by such operations is no longer to be questioned. My only answer is that it seems to me equally clear that the theory of Graves' disease being primarily and always a thyroid disease is a mistaken

theory, and, hence, that the seeming contradiction is because the whole subject abounds with anomalies, as do all problems connected with metabolism, not the least of which is to explain on what surgical principle the present mode of operating in Graves' disease is based, as we will soon note.

We do not yet know much of the physiology of metabolism. Thus the relations of the internal secretions of the little islands of Langerhans to diabetes are no plainer than those of the little parathyroids to fatal tetany. We are yet to learn what enzymes are and what they do. Nor have we yet learned all about antitoxins ar antibodies. Sometimes a chemical process is supposable and at others equally inadmissible. My own provisional hypothesis in this case is that, due to a physiological affinity the thyroid may accumulate a store of enzyme-like toxin brought to it by the circulation which may then act as a nidus for discharging the agent from time to time when the gland is stimulated by fresh supplies of the toxin derived from improper diet. Surgically removing this nidus may then be as beneficial as removal of the spleen sometimes is when it has hypertrophied from noxious accumulations in its substance. But neither this nor any other hypothesis yet offered covers the whole ground. A complete thyroidectomy would be the only recourse if the usual explanation of the benefits of the operation was valid. Instead, at present, only partial resections are recommended. The part of thyroid left, no matter how diseased, then becomes normal as does the patient also. This surgical fact has no parallel elsewhere, certaintly not in the infections or degenerations dealt with by surgeons. Neither a tuberculous gland nor a patch of gangrene can be left to get well, because it has been half cut out. A cure of such a serious toxemia as that of Graves' disease by removing a portion only of the thyroid gland is beyond all present explanation, and can be accepted merely as an empirical fact.

But it is also a fact that Graves' disease, whatever its stage or degree, can be equally benefited or cured by proper medical treatment alone. Failure then is due to difficulty in managing the patient and not the disease. Many women seem incapable of that perseverance in observing the regimen and continuing the medication for the prolonged time that is essential to control a malady which is like diabetes in its requirements for both abstinence and observance. One of the important objects is to enjoin rest from muscular exertion, to secure which the physician should explain to the patient that muscular debility is a specific accompaniment of the affection as much so as in fever, and no transient condition which will-power can overcome. But likewise all fatigue is to be avoided. It is striking how soon certain nervous symptoms, such as headache and insomnia, follow upon both undue muscular and mental exertion in these patients.

On the matter of diet the directions cannot be too positive and

too detailed. Butcher meat is never to be allowed. Fish, if not too oily, as salmon or smelts, seems much less objectionable than meat. Oysters, clams, and lobsters are forbidden. Poultry can be taken sparingly, but not at night. Not more than one egg a day, best taken at breakfast, is allowable. Of game I only allow quail and partridge, but no dark meat birds.

The standard article, however, is milk, which alone will cure many severe cases of Graves' disease if it be taken as the Bedouins and Tartars of Asia take it as well nigh their only food. A Bedouin would no more drink fresh milk than we would eat a raw potato. He always ferments it first, with yeast as the ferment. Most Tartars use the plant keffir as their ferment. Peptonized milk will answer if the patient does not know how to make the fermented milk. Raw milk, on the other hand, is wholly indigestible in the quantities which should be taken in this disease, and if ever taken should be half diluted with Vichy or with lime-water.

Next to living on milk the patient should be a vegetarian, for vegetable albumen rarely disagrees. Bread, particularly if crusty, and rice can be taken ad libitum, but hot soda biscuits are nearly poisonous, and starchy crackers are to be avoided in persons much troubled with headaches. Of vegetables, beans (except string beans) and peas are wholly inadmissible. I would rule out also asparagus and, to a less degree, spinach. Of the cereals oatmeal is forbidden, but the others in common use, particularly hominy, are recommended as they are so often taken with milk and cream. Nearly all the fruits are beneficial except uncooked apples and strawberries. Of course in a disease so marked with digestive disturbances, individual idiosyncracies will have to be respected.

Medicinal treatment holds a high place in my estimation. To every patient I recommend 30 grains of the phosphate of sodium taken at the beginning of each meal. A blue pill or other mercurial laxative taken twice a week is a routine prescription. Then a course of intestinal antiseptics is kept up for months at a time. I usually begin with sodium salicylate and sodium benzoate, of each 10 grains, an hour after each meal. At bedtime I give a capsule containing naphthalene 3 grains and sodium benzoate 6 grains. After a time I substitute a capsule containing phenol bismuth and ammonium benzoate, each 5 grains, of which two should be taken an hour after meals. The principle of these remedies as intestinal antiseptics being understood, every physician can vary the prescriptions as he finds best.

No patient with confirmed Graves' disease should be promised a speedy cure. I once thought that two years' absence of all its symptoms might allow the hope that it would not return, but I do not now, because my experience makes me dread a case of relapse after a long interval of freedom more than I do any other instance of the disease. I have mentioned the patients who, once severely affected

with Graves' disease, apparently remained entirely well for periods varying from three to seven years. They then relapsed and none of the remedial measures which before were so effective were of any avail; four out of the five dying on my hands. This result is not without its analogy in diabetes, for if a diabetic once indulges in starches his glycosuria then increases often for weeks after his indiscretion, though he may have quickly returned to his old observance of rules of abstinence; and as I have mentioned above each of my patients with a late relapse had returned to a meat diet.

ADIPOSIS TUBEROSA SIMPLEX.

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There is a condition which resembles Dercum's disease in respect to certain clinical features, but it differs markedly from adiposis dolorosa in its course, and, unlike the latter disease, is amenable to treatment. The subjects are obese and sometimes extremely so, as in one case which I observed. The disorder may occur in the plethoric or the anemic form of obesity, although more commonly perhaps in the latter.

Circumscribed fat masses appear in the subcutaneous tissues; they form distinct, moderately dense, slightly movable, somewhat flattened tumors, ranging in size from a bean to that of a hen's egg. Their number varies all the way from one-half dozen to two dozen or more. These moderately firm fat-nodules are not distributed over the entire body, but in some cases are confined to the extremities, particularly the lower, and in others, to the abdomen. The tumor masses show no tendency to fuse together and are not elevated above the surrounding surface; they are sensitive to the touch and may be the seat of pain which varies in intensity within rather wide extremes, being moderately severe and distressing in rare cases and trivial or even absent in the majority of instances. The lymphatic glands are not involved, and the skin remains soft, flexible, and non-adherent. The mental processes are normally active, and also the muscles; asthenia is not present, and there is no more indisposition to physical exertion than is observed in cases of obesity as a rule. The knee-jerks are present and the cutaneous sensibility is unaltered, in some cases at least. The mammæ and abdominal panniculus adiposis may be overhanging or pendulous, but not in all cases, as an analysis of the symptoms of the instances reported below will indicate. It is

an uncommon condition, since it was noted in only 4 out of a total of 324 cases.

The etiology is that of general obesity, as far as I have been able to determine. No pathologico-anatomic study of the associated subcutaneous fat-nodules was undertaken, for the reason that they were removed in every instance as the result of treatment of the polysarcia adiposa. Their intimate association etiologically with corpulency is almost undoubted, in view of the fact that their disappearance is determined by proper treatment for the latter condition. For the identical reason, the condition known as tuberosa dolorosa may be excluded.

Brief notes of my cases may here be narrated:

CASE I.—J. H. J., aged forty-three years, single, occupation physician, applied to me for treatment February 4, 1903. The weight was 385 pounds (nude), and the height 5 feet 10 inches. The family history reveals the presence of gout in several generations on the mother's side; the maternal grandfather weighed 250 pounds, and two brothers each weigh 225 pounds. His paternal grandfather died of chronic cardiac disease. Both parents are living, and in good health.

Previous History. Some childish diseases; at the age of ten years was kicked by a horse in the jaw, and as a consequence partook of fluids for a number of weeks. When a return to solid articles of diet was made, he began to take on flesh, and had been going from bad to worse in this regard until the date of his first visit. In recent years the dyspnœa on physical exertion was a most troublesome symptom.

Social History. The patient used spirits quite constantly, although not guilty of excessive indulgence; smoked regularly to a moderate extent since early adolescence; never took muscular exercise systematically. Patient observed that abstinence from alcoholic beverages lead to a slight diminution in bulk and weight, although it is to be recollected that hereditary predisposition is easily traceable. An excessive diet of starches and sweets was also an etiological factor.

Present Condition. Patient complains of breathlessness on exertion; has inclination to rest often and sleep much. Muscular power has of late been diminishing gradually and slight subjective symptoms, referable to the viscera, as the lungs, heart, and stomach, have been manifesting themselves, but distinct asthenia was not observed. An examination of the urine revealed the following result: The twenty-four hour quantity was 2000 c.c.; the specimen was clear, specific gravity 1024; uric acid and urates increased; a trace of albumin, and hyalin and granular casts were noted. There was neither indol, skatol, nor sugar present.

Physical Signs. The face was congested, chest broad and deep, waist thick and prominent, with pendulous abdominal parietes,

while the arms and legs were also quite massive. The respirations were hampered and much labored on slight exertion, and the respiratory sounds, on auscultation, slightly wheezy and attended with a few sibilant rales. The heart's action was exceedingly distant and apparently feeble, and the pulse was small, rapid, irregular, and intermittent. There were no murmurs present and the size of the heart could not be outlined owing to the extreme subpericardial overfatness. No evidences of atheroma were presented, although the aortic sound was somewhat accentuated. From the median line of the abdomen and extending to the right flank, six rather hard masses, four of which were as large as flattened hen's eggs, could be readily palpated in the subcutaneous tissue. They were painful, at times excruciatingly so, and quite sensitive to the touch. There were no similar masses to be found elsewhere over the body.

Treatment. The patient was put upon a suitable treatment for the marked obesity, the chief reliance being placed upon the dietetic restrictions as indicated by the appended diet list:

Morning Meal or Breakfast: An orange, two peaches, or grapefruit, one soft-boiled egg, or an egg cooked in any manner except fried; or, instead of the latter, chicken minced or broiled, 2 ounces; two glasses of skimmed milk; graham bread, 1½ ounces.

Noon Meal or Luncheon: Caviare, 2 drams; raw oysters or boiled ham or sweetbread or fowl or game, 3 to 4 ounces; the meats at this meal are to be taken cold when convenient; salad, 1 ounce (without oil); cheese, 2 drams; bread, rye or bran, ½ ounce; fruit (except strawberries and bananas) 4 ounces; or, instead of the latter, may take 4 ounces of water.

Evening Meal or Dinner: Fish, 2 to 3 ounces; sweetbread or game or poultry or veal, 3 to 4 ounces; one of the following green vegetables—asparagus, spinach, string beans, green peas, cauliflower, celery, sorrel, lettuce, and macaroni with a small amount of cheese, 1½ ounces; graham bread, or toasted bread, ½ ounce. For dessert, may take 4 to 5 ounces of fruit; junket or custards (sweetened with saccharine). Instead of fruit, may take a glass of water.

No liquid at mealtime except as indicated above.

In addition, a glass of Celestines Vichy water four times a day, one hour before mealtime and on retiring, was allowed, for the purpose of combating the excess of uric acid in the blood. Massage with Swedish movements on Mondays, Tuesdays, Thursdays, and Fridays was insisted upon, as well as a tepid bath on rising, followed by active friction of the skin.

The only medicinal substances employed were cardiac stimulants and tonics.

As the result of this treatment there was a gradual loss of weight, and at the end of one year all of the subcutaneous tumors had completely disappeared. The patient, who lived in New England, called on April 30, 1904, when his weight was 300½

pounds. Not a vestige of the former tumor masses could be detected, and the patient reported that pari passu with the loss in weight both the circumscribed tumor masses and the pain had vanished.

CASE II.—Mrs. E. J. B., aged forty-five years, applied for treatment February 2, 1902. Weight 180 pounds (nude); height, 5 feet 5 inches.

Family History: Father stout, and both rheumatism and gout are shown by paternal side of family; the paternal grandmother died of heart disease, while the patient's mother had uratic deposits.

Previous History. Patient had had certain childish diseases, and scarlet fever and measles since marriage. For many years had manifested gouty and rheumatic symptoms at irregular intervals; there had been two attacks of grippe and one of cellulitis affecting the pelvis many years previously. More recently has suffered from flushes and extreme despondency.

Social History. The patient is childless and passing through the menopause, having menstruated but three times in the previous year. There had also been a tendency to suppression of the menstruation from time to time in the preceding years; this was attributed to anemia, from which the patient seemed to suffer at intervals. The patient had paid some attention to systematic exercise and also to the matter of dieting, but not for any lengthy period of time. He had used tea and coffee, though not to excess; had taken wines and spirits with great moderation.

Present Illness. Dates the origin of the present condition back several years, or to the time when the gouty and rheumatic symptoms became aggravated, since which time she has shown a tendency to grow stouter. There has been a decided disposition to gouty pains and swelling and stiffness of the fingers and feet for years, and at present the shoulders are implicated. There has been some dyspnœa upon physical exertion, and undue liability to contract colds. The urine analysis proved negative, although this secretion was strongly acid. A blood examination gave the following result: red cells, 3,870,000; white cells, 10,000; and hemoglobin 70 per cent. The red cells stained normally, and polymorphonuclear leukocytes seemed to be relatively diminished.

Physical Signs. Obvious pallor of mucous membranes and skin, although body is plump and apparently well nourished. The left ventricle of the heart shows a slight degree of hypertrophy, but the myocardium lacks vigor; aortic sound is accentuated, but the palpable vessels are not sclerotic. I accidentally discovered a considerable number (about one dozen) of tumor-like masses in the muscles, more particularly of the thighs, although a few were also observed in the fleshy portion of the forearm. They ranged in size from a Lima bean to that of a somewhat flattened English walnut, and were not elevated above the surrounding surface. Their range of mobility was very slight. They lacked the softness of true fatty tumors

and were not lobulated in character. The patient made no complaint of pain referable to these masses, and a few only were moderately painful on rather severe manipulation.

Treatment. The treatment was similar to that of Case I. A suitable dietary, a glass of Saratoga vichy three hours after each meal and on rising, massage (Mondays, Tuesdays, Thursdays, and Fridays), a walk of three miles daily, and a cool bath on rising, followed by active friction to the skin, constituted the principal elements in the management of the case, and produced a slow and gradual reduction of the weight, which fell from 180 pounds (nude) to 165 pounds. After the loss of about 10 pounds a noticeable reduction in the size of the larger tumor-like masses was observed, while the smaller ones had already disappeared. Later, or in the course of two months, there was an entire disappearance of these circumscribed tumors. In this case a discontinuance of the treatment was followed by a renewed increase of weight up to 179 pounds, and a return of the tumor-like masses described above, although they were neither so numerous nor so large. A recourse to the dietary and *regime* previously employed again led to satisfactory results, with a disappearance of the fatty tumors.

Case III.—Mrs. A. H. F., aged thirty-seven years, nativity American, first consulted me April 9, 1903. The weight at that time was 190 pounds (in clothes), and the height 5 feet 6 inches.

Family History. Both parents living, mother inclined to obesity and is gouty, while the father has chronic Bright's disease. Otherwise no hereditary taint.

Previous History. Childish affections. From girlhood has been troubled with neuralgia and gouty pains at short intervals, but has not suffered so much since marriage. Had an attack of grippe one year ago, and has looked poorly since. There is a history of general nervousness, extending over a period of several years; the patient became despondent and irritable at intervals.

Social History. Married, has two healthy children; menstruation normal. Has dieted for the corpulency, but unsuccessfully; is not fond of exercise.

Present Illness. After the birth of the first child, about ten years ago, began to take on flesh slowly and gradually, with a corresponding increase in the severity of the gouty manifestations. There has of late been considerable dyspnœa on exertion. The urine analysis shows a qualitative increase in uric acid, otherwise it appears normal.

Physical Signs. Nothing abnormal is presented by the lungs and heart, although the first sound is distant. There is no evidence of any cardiovascular change. The fat deposits occur principally over the hips and abdomen. Patient discovered a number of small, non-painful fat masses scattered over both hypochondriac regions. They are painless, although slightly sensitive to the touch.

Treatment. The patient was placed upon a somewhat restricted dietary, particularly with reference to the carbohydrates, and, in addition, the following directions were given: a walk of three miles daily, preferably in the morning; a glass of Saratoga vichy three hours after each meal and on rising, and a warm bath on retiring, followed by active hand rubbing, beginning at the feet.

May 19, 1903. Patient reported upon her condition; weight, 182 pounds; feels herself greatly improved. The rather soft, elastic masses of fat have greatly diminished in size, and now do not exceed in size that of a pea. The same *regime*, including massage, was ordered to be continued, the patient using no medicines.

September 24, 1903. No fat tumors palpable at this time; weight, 168 pounds. Patient states that she feels somewhat nervous. The dietary was now relaxed and a tonic was ordered.

May 10, 1904. The patient still slightly nervous, although she has led an exceptionally active and strenuous life during the past winter; weight, 164 pounds (stripped). Is given to emotional disturbances at intervals. Not a trace of the former tumor-like masses detectable around the waist, and there has been no recurrence since the previous autumn. The patient was able to endure more than many of her apparently healthy friends. No extract of thyroid had been administered, but a tonic was now prescribed composed of strychnine sulphate, extract of sumbul, extract of gentian, and quinine valerinate.

Case IV.—Mrs. F. W. W., aged thirty-two years, nativity American, first called on me September 10, 1901. Her weight was 158½ pounds, and the height 5 feet 5 inches. The family history reveals carcinoma on maternal side (mother and two aunts); father was a paralytic, due to apoplexy. There was no hereditary taint with reference to gout; the patient's mother weighed 175 pounds.

Previous History. The patient had had childish diseases; was treated for spinal curvature at fourteen years of age, and typhoid fever at twenty. During pregnancies was subject to fainting and nervous attacks.

Social History. Menstruation regular, but scanty, with cessations and recurrences; married and has three children, one of whom died of summer complaint. Patient uses tea, but no coffee; has been dieted without success, but has never adopted systematic physical exercise.

Present Illness. This began more than two years previously with fits of indigestion, accompanied by eructations of large quantities of gas; during the same periods she was highly nervous and despondent.

The *physical examination* of the viscera proved negative. The patient was moderately corpulent; circumscribed, deeply seated tumor masses were noted, one large and numerous small ones, especially in the legs. The urine analysis showed nothing abnormal, ex-

cept that this secretion was strongly acid. A blood examination was not made, although the patient did not present any obvious indications of anemia.

Treatment similar to that decribed under Case II was instituted, and after a loss of 5 or 6 pounds in weight about one-half of the small masses had disappeared, while a single large tumor showed considerable diminution in its dimensions. Unfortunately, treatment was discontinued at the end of two months, and hence the result was not satisfactory.

Case I, of this series, manifested symptoms which bear a close clinical resemblance to adiposis dolorosa, especially of the so-called nodular variety. For a considerable period of time while the patient was under my care I looked upon the case as belonging to this form of adiposa dolorosa, for the reason that localized nodular deposits of fat and pain were in evidence. On the other hand, the absence of any psychic disturbance and asthenia out of proportion to the marked polysarcia, and more particularly the complete disappearance of the fatty masses as the result of treatment directed to the extreme obesity, led me to exclude Dercum's disease.

In Case II, the fact that the circumscribed fatty tumor-like growths were, in the main, painless, and readily disappeared as the result of appropriate treatment, led me to believe that they were dependent upon the general obesity.

In Dercum's disease, a study of the postmortem lesions revealed,[1] as prominent features, "irregular atrophy of the thyroid gland, with here and there efforts at compensatory hypertrophy; also extensive interstitial neuritis in various nerves as they passed through the fatty tissue, and, in addition, degeneration in the columns of Goll. In the fourth case—that reported by Dr. Burr—there were present in the thyroid gland changes identical with those above described, interstitial inflammation of nerves, and, in addition, enlargement and gliomatous degeneration of the pituitary body."

The presence of hemolymph glands has also been noted in that disease; they are believed to exert a compensatory function. It must be granted that in Dercum's disease there are grave disturbances of the metabolic processes, and that lesions of the thyroid gland, as well as of the pituitary body, play a significant role in the causation of these disturbances of nutrition. In my own cases the course and results of treatment would seem to contradict the presence of any gross pathological changes in the lymphatic structures, and therefore stamp them as being essentially different in nature and tendencies from adiposis dolorosa—a comparatively benign condition as compared with the latter affection.

[1] Autopsy in a Case of Adiposis Dolorosa, by F. X. Dercum, M.D., and D. J. McCarthy M.D., Amer. Jour. Med. Sci., December, 1902.

Again, it is scarcely conceivable that the mild, nervous and other associated features, as well as the tumor-like masses, which are observed in adiposis tuberosa simplex, and are so easily removed by dietetic and regiminal treatment, could have as an underlying causative condition grave lesions of either the thyroid gland or the hypophysis.

Lipomas, by their painlessness, soft, doughy, semi-fluctuating consistence, their more globular shape, as evidenced by the slight though distinct elevation above the surrounding surface and more or less lobulated character, may be excluded. Moreover, these tumor-like subcutaneous growths are not dependent on associated general obestiy, and are not amenable to medicinal, dietetic, and regiminal treatment.

Launois and Bensaude[2] have described multiple symmetric fat deposits unattended by any disturbance of the general health, except in some cases, in which asthenia or fatigue, with or without irritability, apathy, and even hypochondriasis, have been observed. Adenolipomatosis, however, may be readily differentiated from the cases for which I have suggested the title, adiposis tuberosa simplex. In the first place, adenolipomatosis generally coincides with such widely various conditions as syphilis, albuminuria, gout, carcinoma, asthma, and varicosities, and only rarely with obesity. These tumefactions are symmetric in their distribution, with constant localization in the vicinity of the neck, axillas, and groins, adenolipomatosis being in all probability a disease of the lymphatic system.

On the other hand, the cases which I have herein reported manifest a totally different symptomatology and course. It is especially to be observed that the tumor masses in the condition which I have described show a different distribution (vide supra), and disappear as the result of treatment successfully directed to the associated, and most probably causally related, general obesity, while in adenolipomatosis the local masses of fat tissues seem to enjoy an individuality, "preserving their volume during conditions under which the patients generally become cachectic, and even in the presence of considerable emaciation secondary to tuberculosis, Bright's disease, etc."

C. Feer,[3] after inviting attention to the fact that localized fatty tumors have been described under the titles of painful subcutaneous tubercle, irritable tumor, states that adiposis dolorosa is the association of nerve pain with obesity. This writer claims that in many instances the pain persists after the removal of the fatty tumors, and that the two symptoms—nerve pain and obesity—may arise at different times and run a course by no means concurrent. I have in my possession notes of cases resembling adiposis dolorosa in which

[2] Nouv. Icon. de la Salpêt., 1900.

[3] Rev. de méd., August, 1901.

the symptom pain has undergone decided exacerbations and remissions despite the persistence of the fatty tumors. These cases, it seems to me, are to be differentiated from those which I have reported, or those dependent upon obesity, in which a disappearance of the localized fatty tumors is accompanied by a permanent subsidence of all pain (when present), usually moderate in degree.

It may be questioned whether the results reported in these cases may be properly classed as cures. The concurrent recurrence of the localized fatty tumors and general obesity in Case II and their complete disappearance for a second time indicate that a cure is possible in all cases in which the probable cause (polysarcia) is amenable to hygienic and regiminal measures. In Dercum's disease the usual results of efforts at treatment are diametrically opposed to those obtained in my cases.

THE CHOICE OF OPERATION IN PYLORIC STENOSIS.[1]

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Pyloric obstruction, whether of benign or malignant origin, is one of the most important problems in gastric surgery. I was influenced in choosing this subject for my paper: (1) By the fact of its very general interest to the profession at large; and (2) because the whole field of gastric surgery is manifestly too large to be satisfactorily covered in the limited time at my disposal. Indeed, it has many phases, the consideration of which could very profitably occupy more than the whole of my allotted time. For the sake of brevity, I shall still further limit myself to a consideration of strictures of the pyloric orifice of an organic nature, leaving entirely out of account the interesting but indefinite group of functional and spasmodic affections.

By common consent, and from its essential mechanism, the management of pyloric stenosis is placed beyond the border line of medicine, within the domain of surgery; and rightly so, since it is clearly a surgical problem, pure and simple. Even the most ardent advocate of medical treatment will hardly claim more than temporary benefit from therapeutic measures alone. Medicine cannot solve a problem in mechanics. For permanent relief from his malady the patient must turn to the surgeon. The sooner this fact becomes firmly established in the medical mind, and is allowed to control its action, the sooner will one of the chief causes of that standing reproach to the medical profession, the "chronic dyspeptic," be removed.

[1] Read at a meeting of the Virginia State Medical Society, November 14, 1907.

In seeking relief from a given condition, a consideration of the causes giving rise to it, will often prove of great advantage. Pylorie obstruction in the adult, whatever its nature, has its origin, in the vast majority of cases, in an active or healed ulcer. Pyloric stenosis occurring in infancy is a separate and distinct entity, and will be referred to later. For the certain knowledge of the important part played by gastric ulcer in the etiology of gastric cancer, the medical profession is indebted primarily to the surgeon. In this connection, reference should be made to the notable contributions of Rydygier,[2] Rodman,[3] and more especially the Mayos.[4] More recently these observations have been abundantly confirmed by a wider experience and by other surgeons.

A study of the conditions associated with the production and further continuance of gastric ulcer ought to prove instructive in this connection, since it plays such an important part in the etiology of pyloric obstruction. Then, too, a knowledge of the phenomena presented in the life history of a gastric ulcer will help to explain certain symptoms frequently observed in the course of pyloric obstruction which might otherwise be obscure and difficult of correct interpretation. In this way the diagnosis of pyloric stenosis, whether benign or malignant, not by any means always easy although usually possible, is rendered more simple. But all this, however pertinent and and helpful it might be, would lead us too far afield. Suffice it to say that a clear conception of the close relationship existing between these two conditions, namely, ulcer and cancer, will aid materially in the proper understanding of its pathology, diagnosis, and treatment.

A diagnosis, then, of pyloric obstruction having been made, and the condition being admittedly a surgical one, and amenable to surgical treatment only, the surgeon's chief concern at once becomes the choice of operation. In making this choice, he should be influenced not alone by one, but by many considerations. In the first place, the personal equation of the operator, and the patient as well, should not be disregarded. Some particular form of operation, through greater familiarity and experience with it, or for technical or other reasons, he may be able the better to perform than some others. A surgeon may begin an operation with his plans all laid and his mind made up to follow a certain definite line of action, to perform a posterior gastro-enterostomy, for instance, when after the abdomen has been opened, he is confronted by unexpected conditions, which, if he has the best good of his patient at heart, may compel him to change entirely his method of procedure. This sounds elemental in a company such as this, and it is, but I fancy that every operator has experienced the temptation to carry out preconceived plans in spite of opposing conditions. One should always begin every opera-

[2] Centralbl. f. Chir., 1906, Beilage Nr. 28.
[3] Trans. Amer. Surg. Assoc., 1900, xviii, 38.
[4] Annals of Surgery, 1904, xxxix, 321; 1905, xlii, 641; 1905, xliii,. 537.

tion, particularly upon the abdominal viscera, with an open mind prepared to do that which is indicated by the pathological condition found to be present.

The condition of the patient should always be one of the first considerations in determining upon a given course. Operative procedures, involving undue manipulation or great length of time, may be absolutely contra-indicated in a weak or debilitated patient. It is well to bear in mind that the least one can do that is at all effective, is often the best that one can do. In no class of cases is this more true than in those unfortunates suffering from advanced cancer of the stomach with marked obstructive symptoms. Here a rapidly performed anterior gastro-enterostomy done, perhaps (in order to further shorten the time of operation), with the aid of a Murphy button, always a doubtful procedure, may become the operation of choice.

After the general considerations, some of which I have indicated, come the special ones, and in a patient in otherwise good condition they will most likely determine the choice of operation.

In the case of pyloric obstruction, the result of early cancer, the attempt at extirpation should always be made. In other words, pylorectomy is here the operation of choice. The mortality is but little, if any, greater than in the palliative operation of gastro-enterostomy, while the relief of pain and other disagreeable symptoms is more sure, and the average length of life appreciably greater. In those unfortunate cases in which by reason of adhesion to and invasion of surrounding structures the cancer has progressed beyond the point of extirpation, a gastro-enterostomy is the only thing that offers even temporary relief, and should be done as a last resort. This operation performed under these most unfavorable conditions shows a very high mortality rate, anywhere from 15 to 50 per cent., depending upon the operator. The average prolongation of life is not more than three to six months, and the fact that a patient occasionally lives beyond this time suggests the possibility that with a more radical procedure he might have lived even longer (Murphy).

The operation of pylorectomy has been placed upon a very firm pathological basis by the classical work of Billroth, Kocher, Mikulicz, Hartmann, Mayo, and others. The later reports from the different clinics show a very low rate of mortality, that from the Mayo Clinic, 9.5 per cent., being the most satisfactory. The technique as given by Mayo is perhaps the simplest. I will not take up your time with a description of it, but refer you to his paper. This operation can be performed by the average operator in from one to one and one-half hours. The anastomosis is effected by the Billroth "No. 2" method, that is, the complete closure of both duodenal and gastric stumps with an independent posterior gastrojejunostomy. This is the operation of choice, both on account of the ease of accomplishment and safety. Personally, I have had great satisfaction with this operation

in the limited number of cases in which I have performed it—eight times without a death.

Great difficulty is sometimes experienced, after the abdomen has been opened, in distinguishing between an early carcinoma and the indurated and hypertrophied gastric wall about a chronic ulcer. Indeed, at times it is absolutely impossible to make a diagnosis from gross appearances alone, even after the specimen has been removed. In conjunction with Dr. Julius Friedenwald I reported such a case at the last annual meeting of the American Gastro-enterological Association in Altantic City. Similar cases have been reported recently by Bloodgood and Lund. In the case just referred to the clinical diagnosis was ulcer. At the operation on account of the indurated tumor and the infiltration of the stomach wall and the fat along the lesser curvature, the diagnosis of cancer was made. In the laboratory, on gross inspection, it was at first supposed to be cancer; but later microscopic examination of sections revealed nothing but inflammatory tissue. In another case upon which I operated some years ago in which clinically almost identical conditions prevailed, a very early cancer was discovered only after careful microscopic examination of sections through the base of the ulcer. The lesson to be learned from these observations tends to confirm Rodman's contention that, in case of doubt, especially in persons past middle life, and in ulcers that have run a chronic course, or in which there is much cicatricial tissue present, pylorectomy, from the standpoint of prophylaxis as well as cure, is the operation of choice.

Heretofore, we have been dealing with the actual existence of carcinoma, or with conditions in which its presence may be reasonably suspected. In the cases of benign obstruction, however, it will be found for one reason or another that the choice of operation will eventually lie between gastro-enterostomy and some other surgical procedure, pylorectomy, pyloroplasty, gastro-duodenostomy, etc. I have already discussed the conditions under which pylorectomy should be given the preference. It now remains to consider the circumstances which should influence one in making a choice between the other operative procedures. Many arguments have been advanced, based upon physiological and other grounds, theoretical and practical, both for and against the operation of gastro-enterostomy; but at present it is, with the majority of surgeons, the operation of choice. Undoubtedly upon strictly physiological grounds, the advocates of pyloroplasty and gastroduodenostomy have the better of the argument. The clinical fact remains, however, that whatever the outcome under other circumstances, in the majority of cases of pyloric stenosis, properly selected and properly done, the operation of gastro-enterostomy is followed by satisfactory results. This fact influences greatly, and rightly so, the course of action of most surgeons in determining upon the particular operation to be performed.

The various arguments for and against these two procedures have been from time to time brought out by different writers, notably the excellent article of Cannon and Blake.[5] More recently, the studies in the physiology of altered digestion and the metabolism of fats, following these operations made by Katzenstein, Joslin, Murphy, Patterson, Leggett and Maury,[6] and others are of interest and value. In this connection Paterson's[7] conclusions are worth quoting in full as embodying the latest ideas upon the physiological effects of gastro-jejunostomy: "(1) A certain amount of bile and pancreatic juice enters the stomach after gastro-jejunostomy, but the amount is small and has no injurious effect. (2) The acidity of the gastric contents is markedly diminished, usually about 30 or 35 per cent. This is due partly to a diminution of the total chlorides secreted, and partly to the partial or complete neutralization of the free hydrochloric acid by the alkaline bile and pancreatic juice, and probably also to earlier stimulation of the pancreatic secretion, and compensatory earlier fall of the gastric secretion. In gastric ulcer cases the removal of spasmodic stenosis of the pylorus, likewise tends to diminish the total acidity. (3) Gastric digestion is impaired but not lost after gastro-jejunostomy. (4) The motility of the stomach, if normal before operation, is for practical purposes unaffected. Gastrojejunostomy is, therefore, not a drainage operation. Its beneficial effects on gastric ulcer are due to the diminution of the acidity of the gastric contents. (5) Gastrojejunostomy has no material effect upon the metabolism of the human body, the percentage of nitrogen and fat absorbed being within the limits observed in individuals who are apparently healthy. This chemicopathologic evidence is supported by evidence of clinical experience."

Further observations along these lines after long periods of time will have to be awaited before any very definite conclusions are warranted.

As indicated above, gastro-enterostomy is the operation of choice on the part of most surgeons, and its field of usefulness is being constantly widened. This is true largely because the technique of the operation has been greatly simplified. The composite "no-loop" operation described by W. J. Mayo in 1906 is a fairly simple operation, and can be readily performed by surgeons without any special training in abdominal surgery. The results of this operation have been on the whole satisfactory, especially in the larger clinics, where the mortality has become merely nominal—a fraction of 1 per cent.—and the functional results, according to the published reports, excellent. It must be observed, however, that this operation is one which, in order to obtain the best results, requires upon the part of the operator a considerable amount of skill and experience in its performance.

[5] Annals of Surgery, 1905, xli, 686.
[6] Ibid., 1907, xlvi, 549.
[7] Trans. Section on Surg. and Anat., Amer. Med. Assoc., 1907, p. 80.

According to the published reports, the results of the occasional operator are found to be not nearly so satisfactory as those obtained in the hands of the more skilled and experienced surgeon. This is a point of considerable importance, and one that has not been sufficiently emphasized. The same is true, to a certain extent, of the operation of pyloroplasty or gastroduodenostomy, but here, owing to the different mechanism and less complicated technique, the results in the hands of different operators are likely to be more constant. Unfortunately, in the case of neither operation have the end results been observed long enough, or have they been studied with sufficient care and detail, to enable one to state accurately the relative advantages and disadvantages of the two methods. Both have their good points. Each has its objections.

From a purely physiological standpoint it seems that the advocates of the pyloric operation have the advantage, but unquestionably the clinical results obtained after gastro-enterostomy in the presence of obstruction are better than the physiologists would have us believe. In discussing the relative advantages and disadvantages of the pyloric operations and those in which the stoma is placed at some distance from the pylorus along the greater curvature of the stomach, I shall consider the "no-loop" operation of Mayo as the best type of the gastro-enterostomy operation, and the plastic operation on the pylorus described by me in 1903, as the most satisfactory type of the pyloric operation.[8] The advantages of the Mayo operation over all other forms of gastro-enterostomy except as indicated above, in which a hurried operation for advanced cancer is to be performed, are so obvious as to need no further discussion.

One must not forget that gastro-enterostomy performed in the presence of an obstructed pylorus is a much more satisfactory procedure than when the pylorus is unobstructed. Hence, better results are to be expected from the operation done under the conditions with which we are dealing in this paper than under other circumstances.

The chief idea in placing the stoma at the most dependent portion of the stomach, is to bring about better drainage, by calling in the aid of gravity. This assumes that the stomach is a relatively passive bag. But as pointed out by Cannon and Blake, this is not the case. The stomach is at no time during digestion in the condition of a passive reservoir, but vigorous peristaltic waves continue to pass over the pyloric half of the stomach, from within a few minutes after food is ingested, until it has entirely emptied itself. It would appear from the experiments of these observers carried out upon cats, and those of other experimenters upon dogs, that as long as there is even the slightest opening through the pylorus, a certain amount, at least, of food will continue to pass through it. It will be objected by some that it is a far cry from the stomach of a healthy cat or dog to that of

[8] Johns Hopkins Hospital Bulletin, 1902, xiii, 155.

a diseased human being; but the underlying physiological principle is the same, and the question of drainage of the stomach through the newly formed stoma, or the production of physiological rest of an ulcerated or contracted pylorus through the same means, must remain for the present in doubt.

Among the specific objections that have been urged against gastro-enterostomy are the development of peptic ulcer of the jejunum. Some 33 cases, many of them fatal, of this interesting condition have been reported in the literature up to the present time, The affection seems to be much more rare in this country than abroad, but a single case having been reported here in the human being. Watts has observed it once in a dog. The exhaustive monograph of Gosset, published in 1906, brings the subject up to date, and shows that it occurs much more frequently in males than in females; and that it occurs with slightly greater frequency following anterior operations than posterior. No case, so far as I can find, has been reported after the "no-loop" operation, nor has it followed operation for cancer. The causes of this interesting affection are not definitely known, but its relation to marked hyperacidity seems to be pretty constant. As pointed out by Robson, many more cases have probably occurred, but have passed unrecognized because they were non-perforating or obscured by other complications.

The development of spur-formation, the formation of kinks of the intestine, and the presence of the vicious circle, so common in the older loop operations, are now by the later and more improved methods happily rarely met with, but when they do occur they are of the greatest gravity, and in their management tax the resources of the surgeon to the utmost.

The advantages of pyloroplasty are obvious, preserving, as it does, the natural anatomical and physiological outlet. A year ago I reported a three years' experience with this operation, covering a list of 33 cases.[9] During the past year I have operated upon 12 additional cases, making 45 in all. In this series of cases I have endeavored, as far as possible, to test the method in all classes of benign stenosis of the pylorus and its attending complications. In this list are included examples of practically every condition with which one is likely to meet, namely, dilatation of the stomach, dense adhesions, hypertrophy and cicatricial thickening of the stomach wall, acute and chronic ulceration, hemorrhage, pylorospasm, etc. The results thus far obtained have been most satisfactory. I have found no case in which the operation was contra-indicated, or could not be performed. The objections urged against it, namely, difficulty of performance in the presence of adhesions and dense cicatricial tissue about the pylorus, are, in my experience, more fanciful than

[9] Surg., Gyn., and Obs., 1906, vol. ii, p. 163.

real. I have performed the operation many times in the presence of adhesions and cicatricial tissue of the densest character. The ease with which it can be performed depends largely upon what Kocher[10] has called "mobilization of the duodenum." This procedure was first suggested and insisted upon in my original paper, and if the duodenum is sufficiently freed to allow of its being brought easily into apposition with the stomach wall, as is possible in practically all cases, the difficulties of the operation will be largely done away with.

This operation has the additional advantage that it renders possible the excision, when it is deemed advisable, of an ulcer, active or bleeding, or cicatricial tissue, from the anterior gastric or duodenal wall. I have on several occasions been able to do this. It is perfectly possible to provide a pylorus of ample diameter. One should, however, not make the opening too large, as it might give rise subsequently to disagreeable regurgitation of bile, which has been observed by Mayo. One of the most satisfactory features of the operation is the almost entire absence of postoperative nausea and vomiting. Just why this should be so I do not know, unless it has to do with the division of the pylorus, and the doing away with pylorospasm. In the majority of cases relief has been immediate and marked, but Munro[11] has found that it came a little later in his cases than it did after the operation of gastrojejunostomy. The mortality rate is about the same, perhaps a little better, than that of gastro-enterostomy. Dr. Julius Friedenwald has kindly studied the digestive changes present in a number of my cases, both before and after operation. His reports show uniform restoration to a practically normal condition of the stomach, both as to size, function, and motility.

The technique of the operation as originally reported by me has been modified by Gould,[12] and the majority of operators who use it at all prefer this modification, making use of intestinal clamps. I still prefer the original method and the interrupted mattress suture of Halsted, believing the clamps to be unnecessary, and for the anterior wall, at least, the interrupted to be safer than the continuous suture, particularly in the presence of dense cicatricial tissue. I would, therefore, in all cases of benign stricture of the pylorus give the preference to pyloroplasty as against gastro-enterostomy, believing that it better than any other method fulfils the conditions to be met.

Stenosis of the pylorus in infancy, as indicated at the beginning of this paper, is a distinct pathological entity and should be considered by itself. Scudder,[13] in a recent monograph, has collected 155 cases

[10] Zeitsch. f. Chir., January 10, 1903, Nr. 2, p. 33.
[11] Annals of Surgery, 1907, xlv, 818.
[12] Operations upon the Stomach and Intestines, 1906, p. 225.
[13] Boston Med. and Surg. Jour., 1907, clvii, 321.

reported in the literature. There is uniformly found a tumefaction occupying the position of the normal pylorus. This consists of a hyperplasia of the circular, muscular fibers of the pyloric segment. Various theories of the etiology have been advanced, all interesting but unsatisfactory.

As to the choice of operation for this very interesting pathological condition, Scudder has this to say: "Pyloroplasty and gastro-duodenostomy, whether of the Kocher or Finney type, are theoretically and physiologically ideal procedures. Posterior gastro-enterostomy is proved to be physiologically satisfactory, and in these cases of infantile stenosis is certainly anatomically the choice of all procedures." Whether the obstructed pylorus recovers itself after the gastro-enterostomy and functionates naturally after a time, is as yet undetermined, because there are no records of autopsy findings long after operation. Meanwhile owing to the peculiar pathological conditions present and the difficulty of manipulation on account of the small size of the structures dealt with, gastro-enterostomy should probably be given the preference.

Personally, I am wedded to the operation of pyloroplasty because I do it better than any other, and now perform it altogether, except in case of malignant disease. I have been led to this position by the fact that my results have been so much more satisfactory with this operation than with any method of gastro-enterostomy that I have employed. I have found it easier of execution and requiring less time in its performance than gastro-enterostomy. It is only fair to add, however, that my results after Mayo's "no-loop" operation in cases of gastric cancer have been most gratifying. In the final decision, then, as between these two methods of precedure, since both are attended by an equally low rate of mortality and both give clinically excellent results, the individual operator should be guided for the present in his choice of operation by his own personal equation. Having at all times, first and foremost, the good of his patient at heart, he should choose that particular method which has been followed by the best results in his own hands, being zealous at all times to perfect himself in those methods having a sound physiological and pathological basis.

THE OCCURRENCE OF CONGENITAL ADHESIONS IN THE COMMON ILIAC VEINS, AND THEIR RELATION TO THROMBOSIS OF THE FEMORAL AND ILIAC VEINS.

By J. Playfair McMurrich, M.A., Ph.D.,
Professor of Anatomy in the University of Toronto, Toronto, Canada.

In 1906 I presented to the Anatomical Section of the British Medical Association at its Toronto meeting a preliminary notice of certain congenital adhesions occurring in the left common iliac vein.[1] Since then I have continued my observations on material from the Anatomical Laboratory of the University of Michigan, and also upon a number of veins obligingly placed at my disposal by Dr. Downey L. Harris, City Pathologist of St. Louis, Mo. I have thus been able to examine altogether the iliac veins of 107 individuals, and can confirm and add to the results given in the earlier communication.

The adhesion consists of a fusion of the anterior and posterior walls of the vein, a diminution or division of its lumen being thereby produced. In many cases it takes the form of a column extending between the two walls of the vein (Fig. 1), sometimes circular, and from 1 to 4 mm. in diameter, at other times more oval, its longer diameter reaching as much as 6 mm.; it varies in height and position, in the majority of cases being situated lateral to the median line of the vein, so that the lumen to the medial side of it is greater than that to the lateral side.

In a second type the adhesion was marginal in position, occurring at the lateral border of the vein, so that the lumen was merely diminished but not divided. Of this type two subordinate forms may be distinguished, the more important of these being that in which the adhesion is of a more or less triangular form (Fig. 2), its base, corresponding to the lateral border of the vein, measuring from 8 to 18 mm., while its height varies from 5 to 10 mm. in different individuals. In such cases there is a somewhat sudden diminution of the lumen of the vein corresponding to the height of the adhesion. In the other subordinate type (Fig. 3) the adhesion is a linear one along the outer border of the vein, and may readily be overlooked; it produces but little diminution of the caliber of the vessel.

A third type (Fig. 4) differs from that just described in that the adhesion is at the medial border instead of at the lateral border of the vein. Examples of this type are rare, only two having been observed, but in both these the adhesion produced a very marked diminution of the lumen, reducing it to about one-third the diameter

[1] British Medical Journal, 1906, II, 1699.

which it possessed above and below the adhesion. The fusion extended from a point on the medial border of the left common iliac vein at its junction with the right common iliac, and extended up-

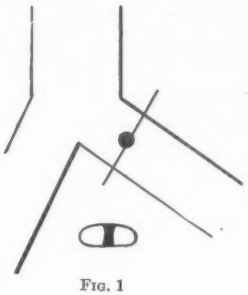

FIG. 1

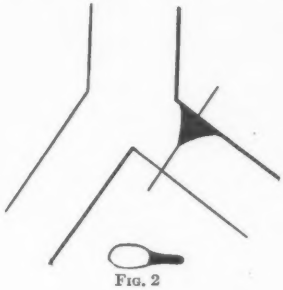

FIG. 2

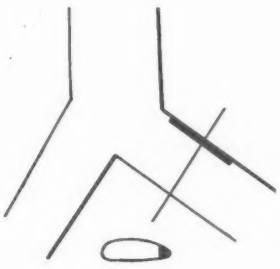

FIG. 3

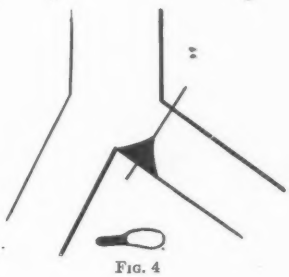

FIG. 4

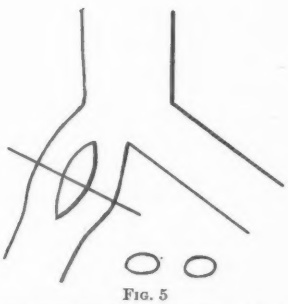

FIG. 5

In the figures the veins are represented as transparent and the adhesion is indicated in solid black. A diagram of a transverse section of the vein passing through the adhesion is also given in each case.

ward and outward so as to have an elongated triangular form and to lie almost at right angles to the axis of the common iliac vein.

Finally, a fourth type (Fig. 5) may be recognized, in which a perforation replaces the adhesion, the vein being double for a limited

portion of its extent. Examples of this type are the rarest of all, but one having been observed; nevertheless, it is most important from a morphological standpoint, in that it affords a possible explanation for the occurrence of the more frequently occurring adhesions.

The frequency with which the adhesions occur is somewhat remarkable. In the 107 cases examined adhesions occurred in 35, making a percentage occurrence of 32.7. These adhesions were distributed according to the different types mentioned above, as follows:

Type I.	Columnar	15
Type II.	Marginal:	
	(*a*) Triangular	11
	(*b*) Linear	5
Type III.	Medial	2
Type IV.	Perforated	1
Total		34

One case is not included in this list, inasmuch as it presented what seemed to be a combination of types II*a* and III, a strong adhesion projecting from the lateral border of the vein medially, and another occurring at the medial border, so that the interval between the free edges of the adhesions was only about 1 mm. broad, the diameter of the vein immediately above and below the line of the adhesions being 1.5 mm.

A most striking peculiarity in the distribution of the adhesions was their enormous preponderance in the left vein as compared with the right. Of the 35 adhesions observed, but 3 were in the right vein, the percentage of occurrence in the left vein being 29.9; or, in other words, the adhesions in the left vein formed 91.4 per cent. of the total number. Whether the frequency of occurrence differs in the two sexes, my observations do not permit me to say with any degree of certainty, since out of the 107 individuals examined, but 17 were females. Of these, 4 showed adhesions, this number being 23.5 per cent. of the total number of females examined. The number examined was, however, too small to give this figure definite value.

The significance of these data in connection with the occurrence of thrombosis of the femoral and iliac veins seems to be very great. I do not intend to discuss the proximate causes of this thrombosis, as these lie entirely outside my province. But it is clear that any arrangement tending to interfere with the flow of blood through the veins must act as a contributory cause, and, therefore, a factor in the etiology of the trouble. It is well known that a large majority of the thromboses occur upon the left side, and it seems altogether reasonable to associate this fact with the preponderating occurrence of the adhesions described above upon the left side. Virchow long

ago pointed out that the anatomical relations of the right common iliac artery and the left common iliac vein might well contribute to the occurrence of thromboses on the left side, the artery as it crosses the vein exerting a certain amount of pressure upon it and thereby tending to produce some stasis or retardation in the flow of the venous blood. Add to this the occurrence of adhesions in the left vein in nearly 30 per cent. of the individuals examined, and we surely have a combination of conditions which warrant an association of the anatomical with the pathological phenomena.

Sex.	Age.	Cause of Death.	Type of adhesion.	Vein in which adhesion occurred.
Male	51	Fatty degeneration of heart.	I	Left.
"	58	Carcinoma of stomach.	IIa	"
"	29	Chronic interstitial nephritis.	IIa	"
"	41	Lobar pneumonia.	IIa	"
"	36	Mitral insufficiency	I	"
"	39	Acute fibrinous peritonitis.	I	Right.
"	31	Psoas abscess.	IIa and III	Left.
"	65	Acute miliary tuberculosis.	IIa	"
"	32	Mitral and aortic insufficiency.	I	"
"	70	Valvular disease of heart.	I	Right.
"	70	Nervous prostration.	IIb	Left.
"	72	Senile dementia.	IIa	"
"	40	Pneumonia.	III	"
"	82	Exhaustion.	IIb	"
"	?	Kidney disease.	I	"
"	56	Chronic mental disease.	I	"
"	83	Heart disease.	I	"
"	42	Peritonitis.	IV	Right.
"	44	Apoplexy.	IIb	Left.
"	56	Pneumonia.	IIa	"
"	40	Pulmonary tuberculosis.	IIa	"
"	75	Dysentery.	IIa	"
"	63	Dysentery.	IIa	"
Female	49	Acute dilatation of heart.	III	"
"	39	Cerebral hemorrhage.	IIb	"
"	48	Fracture of base of skull.	IIa	"

As regards the causation of the adhesions, I have little to add to the opinion expressed in my preliminary communication. That was to the effect that the adhesions are congenital in their nature, due to the incomplete disappearance of a loop by which the iliac vein in the embryo originally surrounded an artery, probably the umbilical. Of the existence of such a loop we have evidence from what has been observed in certain of the lower animals, and it is interesting to note that a perforated condition of the vein, a condition practically producing a loop arrangement, is among one of the types of adhesions recognized above. Furthermore, it may be noted that the extraordinary frequency of the occurrence of the adhesions on

the left side as compared with the right is in harmony with this idea, the pressure of the right artery upon the vein being probably the cause by which an inhibition of the development, normally resulting in the complete disappearance of the loop, has been produced. The adhesions in the great majority of cases occur at the level at which the crossing of the vessel takes place. At the same time it must be recognized that the pressure of the artery is not in itself the cause of the adhesions; the occurrence of isolated cases in the right vein and of occasional cases in the left vein considerably below the level at which it is crossed by the artery being evidence of an ulterior cause, which I take to be the embryonic loop. It may be added that the study of sections taken through two suitably preserved veins in the region of the adhesion showed no evidence of inflammatory or other pathological processes.

The accompanying table shows the sex, age, cause of death, and type of adhesion in the majority of cases observed. In a few cases the necessary data were lacking, and in some instances the data in the third column are wanting in precision, but are given as furnished.

ACUTE GLANDULAR FEVER.

By Glenn I. Jones, M.D.,

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The lack of consideration of acute glandular fever as an independent disease, having a distinct and characteristic entity, or as probably being an aberrant form of influenza nostras, typhoid fever, or some other acute infectious disease, and the prevalence of many cases of fever of 101° to 104° F., with daily remissions of 1° to 2°, in which no positive diagnosis has been made, was the stimulus to investigate acute glandular fever as a common malady, and claim for it consideration and a conspicuous place among the acute infectious fevers.

Definition. Acute glandular fever is an infectious disease developing, as a rule, without premonitory signs, and characterized by slight redness of the throat, high fever, and swelling and tenderness of the lymph glands of the neck, particularly those behind the sternomastoid muscles. The fever is of short duration, but the glandular hypertrophy persists for from ten days to four weeks.

Historical. The disease was first recognized by Pfeiffer, of Weisbaden, in 1889, who called especial attention to it under the name of "Drüsenfieber." Since Pfeiffer's description of the disease cases have been reported by numerous authors, mostly in Ger-

many and France. Heubel, Dawson Williams, Comby, Donkin, and J. P. West have contributed largely to the literature of glandular fever, but the disease continues to be considered uncommon and insignificant among infectious diseases.

ETIOLOGY. It occurs endemically and sporadically, especially among children. Exposure to cold and damp is supposed to have some relation to the disease. Eighty per cent. of all cases reported since its recognition have occurred in children. Byers reports 33 cases, in which the youngest was thirteen months and the oldest twenty-five years old. F. Marsh Dolloway reports 4 cases in adults twenty-four to forty-two years of age. Neuman claims it is due to a streptococcic infection, the organism entering by way of the tonsils without producing any local lesion, while H. Koplik suggests infection may be by way of the thoracic duct. Alerand, in France, has investigated thoroughly and written extensively on the atrium of infection through the nose and throat, and the relation to tuberculosis. It has been suggested that the disease may be a peculiar form of influenza.

SYMPTOMATOLOGY. The period of incubation is from five to seven days. The onset is usually sudden, the patient complaining of headache, pain in the abdomen, vomiting, anorexia, and probably chills. The bowels are constipated, but the patient may rarely suffer from diarrhœa; the tongue is coated, and the face flushed; the evening temperature is 102° to 104° F., while the morning temperature is a degree or a degree and a half lower. The pulse rate is 90 to 130. On the second to the fifth day the enlarged glands appear, and during the course vary in size from a pea to a pigeon's egg, are quite tender, but there is rarely any redness or swelling of the skin. The swelling of the glands persists for two or three weeks. In the severe cases headache is always complained of as an initial symptom, together with abdominal pain and vomiting. Byers, in his series of cases, found the throat unaffected beyond a slight congestion. Many of the patients complained little or not at all until the glands of the neck seemed suddenly to enlarge. The glands affected were the deep ones under and in front of the sternomastoid muscle. No suppuration occurred in any of the cases and the enlargement of the glands subsided in a week or two. The lymph nodes are hard, tender, freely movable, and form a regular chain around the neck. The axillary and inguinal glands are most always involved, the spleen is enlarged in 80 per cent. of the cases, and the liver in 90 per cent. Mesenteric glandular enlargement was found in 40 per cent. Convalescence is, as a rule, very rapid, and uninterrupted by complications.

DIFFERENTIAL DIAGNOSIS. *Acute leukemia* in the early stages closely resembles glandular fever. Differentiation is made by blood examination, the leukocytosis in leukemia being marked and persistent, 1 to 30 to 50 being the relation of white to red cells.

Anemia is pronounced and progressive, and the temperature of longer duration than in glandular fever. A differential leukocyte count shows the predominance of lymphocytes or myelocytes.

Syphilis is excluded by a history of initial lesion or lues in the parents, by marked anginose symptoms, and cutaneous eruptions, together with response to mercury.

Pseudoleukemia. In Hodgkin's disease the glandular enlargement is at first unilateral, and is accompanied by progressive emaciation with marked anemia, œdema, and late pyrexia, the fever usually being intermittent.

Tubercular adenitis is excluded by the presence of a tubercular history. The glandular involvement is usually localized and accompanied by redness and tumefaction of the skin, with suppuration. The fever of tubercular adenitis is of longer duration than that of glandular fever. By reaction to tuberculin or demonstration of tubercle bacilli in the sputum, the diagnosis is corroborated.

CASE I.—W. W., male, white, aged sixteen years; born in West Virginia; occupation, farm laborer; well nourished and developed. Brought to hospital on morning of August 31, after having been confined to house two days. Complained of headache, pain, and stiffness in neck, pain in abdomen, cough, and weakness. The temperature on admission was 104° F.; pulse, 96; respirations, 28. The patient gives no history of disease predisposed to by heredity. No history of prodromes preceding confinement to house, and was perfectly well two days previous to admission to hospital.

The face was flushed, expression calm, eyes bright, decubitus dorsal recumbent. The skin was dry and fine. The glands of the cervical region very slightly enlarged, the neck somewhat stiff and tender. No redness of skin above the glands. Tonsils, nasal and oral pharynx, slightly hyperemic. Examination of chest gives negative physical signs. The heart was normal, the pulse-rate 96, the pulse full. Blood pressure, 115 mm. The pulse declined gradually with the fever and remained of good quality and volume. Blood pressure, 130 mm. on fifth day.

Examination of Blood. Malarial parasite negative on the second and sixth days. Widal reaction negative on the second, sixth, fourteenth, and twenty-first days. Red blood count, 4,000,000; hemoglobin, 90 per cent.; leukocytosis, 14,000 on the sixth day, 8900 on the twenty-first day.

The temperature reached fastigium (104.6° F.) on the fourth day and persisted, with slight daily remissions of 1° to 2°, until the seventh day, when the temperature, declining by lysis, became normal and so remained.

Gastro-intestinal symptoms present were anorexia, fetid breath, tongue moist, swollen, and heavily coated, with reddened tip and edges. Spleen markedly enlarged. Liver slightly enlarged. Abdomen tender on pressure. Stools well digested. No tympanites,

distention, or diarrhœa present preceding, during, or following the disease. Slight dysphagia. Rose spots negative. The glandular hypertrophy, pain, and tenderness first noticed in the postcervical region later became evident to a less prominent degree in the axillary and inguinal regions. The mesenteric glands were never palpable. The pain and tenderness over the glands ceased with the decline of fever, but the glands remained discretely enlarged, though diminishing, at the time patient was discharged. Examinations of sputum for Bacillus tuberculosis proved negative on two occasions during the course of the disease.

Case II.—S. F., female, white, aged twenty-seven years. Patient was taken ill with headache, anorexia, abdominal pain, and slight dysphagia. Temperature, 103° F.; pulse, 96; respirations, 26. Glandular enlargement became evident on the fourth day of disease. The glands were not painful, but slightly tender on pressure and unaccompanied by redness of skin or tendency to suppuration. The temperature became normal on the eighth day, and so remained; the glandular enlargement persisting for over three weeks. Convalescence was uninterrupted and not followed by prostration or anemia. Patient was kept confined to bed for five weeks after cessation of the fever because of glandular condition, although the general condition was good after the return of temperature to normal. Widal reaction negative on the eighth day; leukocyte count, 7000 on the eighth day. A tentative diagnosis of enteric fever was made in both instances, but was later abandoned in the absence of frank symptoms.

Glandular fever presents many of the characteristics of influenza, and may probably be associated with influenza as an aberrant form. If Bacillus pfeiffer should be found in the secretions, glandular fever should be considered associated with endemic influenza-nostras or la grippe, occurring sporadically as a protean type; but repeated efforts have not demonstrated this association. The highly contagious nature of influenza and pandemic invasions are absent in glandular fever. Splenic and hepatic hypertrophy are rarely present in epidemics of influenza occurring in the United States.

The absence of characteristic features of typhoid fever in these cases, as in a score or more which had come under my observation in the George Washington and Emergency Hospitals, led me to the conclusion that many of these cases are acute infectious diseases other than typhoid. The absence of prodromal symptoms, rose spots, typical pulse, Widal reaction repeatedly tested for, and the presence of glandular hypertrophy with pain and tenderness, the glands remaining enlarged after the cessation of the disease without suppuration, the short duration of the fever, with rapid convalescence, and the presence of leukocytosis during the fever tend to a diagnosis of some disease other than enteric fever. I believe acute glandular

	Influenza.	Acute Glandular Fever.	Leukemia.	Tubercular Lymphadenitis.	Typhoid Fever.
Onset	Abrupt.	Abrupt.	Gradual.	Gradual.	Gradual.
Causes	B. pfeiffer.	Unknown.	Unknown.	B. tuberculosis.	B. typhosus.
Fever	Remittent or continued.	Continued.	Variable.	Intermittent and remittent.	Continued.
Nutrition	Temporarily impaired.	Temporarily impaired.	Progressive emaciation, weakness.	Emaciation, slight or extreme.	Temporarily impaired.
Weight	Loss followed by recovery.	Loss followed by recovery.	Progressive loss.	Progressive loss.	Loss followed by recovery.
Anginose symptoms	Usually marked.	Absent or very slight.	Absent.	Always present.	Variable.
Spleen	Normal.	Hypertrophied.	Hypertrophied.	Normal.	Hypertrophied.
Blood changes	Slight secondary anemia; slight leukocytosis.	Slight secondary anemia; slight leukocytosis.	Extreme secondary anemia; leukocytosis marked and persistent; marked increase of myelocytes or lymphocytes.	Secondary anemia.	Slight secondary anemia. Leukopenia.
Glands	Rarely involved; always confined to cervical region; never suppurate.	Discretely enlarged, painful, and tender; never suppurate; cervical, axillary, and inguinal glands involved; hypertrophy subsides gradually; pain and tenderness cease with fever.	Markedly enlarged; no pain or tenderness other than produced by pressure; never suppurate; cervical, axillary, and inguinal glands involved; hypertrophy progressively increases, rarely subsides.	Cervical most commonly involved, usually localized; tend to suppurate and coalesce.	Glandular involvement very rare.
Sputum and nasal secretions	B. pfeiffer, probably.	Negative.	Negative.	B. tuberculosis, probably.	Negative.
Duration	Weeks.	Weeks.	Prolonged, months or years.	Months.	Weeks or months.
Widal reaction	Negative.	Negative.	Negative.	Negative.	Positive.
Gastro-intestinal disturbances	Vary; may be slight or severe.	Onset with vomiting; during course resembles typhoid.	Slight at first; more pronounced as disease progresses.	Negative.	Marked.
Glandular enlargement	Follows fever.	On the fourth or fifth day after onset of fever.	First evidence of disease.	Followed by fever.	Follows fever. Gradual,
Convalescence	Gradual.	Rapid.	Rare or retarded.	Tardy.	
Complications	Occasional.	Rare.	Rare.	Common.	Frequent.
Mesenteric enlargement	Never.	40 per cent. of cases.	Late.	Probable.	Rare.

fever to be a very common disease, unrecognized, and that it frequently is mistaken for aberrant forms of typhoid or influenza. From my observation and study of cases, I have become firmly convinced that some cases of enteric fever of short duration have been nothing other than acute glandular fever, and that this disease should be given a more prominent place than it has among acute infectious diseases, not only as occurring among children, but among adults as well. The annexed table may prove serviceable in the differential diagnosis.

EPIDEMIC CEREBROSPINAL MENINGITIS IN HARTFORD, CONNECTICUT, DURING 1904–1905.

WITH SPECIAL REFERENCES TO THE CASES TREATED AT THE HARTFORD HOSPITAL.

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Connecticut has been visited by three previous extensive epidemics of cerebrospinal meningitis, which have been recorded with painstaking accuracy by the physicians residing in the towns where it was especially prevalent. The first epidemic, continuing from 1806 to 1816, is well known to the student of medical history in this country by the excellent little monograph which Elisha North,[1] then of Goshen, wrote upon it. Dr. Lemuel Bacon, in a manuscript which is still extant, has also discussed this epidemic as it appeared in Hartford. The second epidemic was seen in Middletown in 1823, and formed the subject of a forgotten admirable pamphlet by Dr. Thomas Miner, who called the disease typhus syncopalis.[2] He had previously, also, referred to it in a book, which he and Dr. William Tully wrote, entitled *Essays upon Fevers and Other Medical Subjects*.[3] The third epidemic occurred in 1873, and formed the basis of a paper by Dr. Horace S. Fuller, of Hartford, which, unfortunately, has never been published. The epidemic we shall consider began in March, 1904, and continued, though in a much abated form, until December, 1905.

[1] A Treatise on a Malignant Epidemic Commonly Called Spotted Fever, New York, 1811, pp. 250.

[2] Typhus Syncopalis, Sinking Fever, or the Spotted Fever of New England, as it Appeared in the Epidemic of 1823, in Middletown, Conn., Middletown, 1825, pp. 48.

[3] Essays on Fevers and Other Medical Subjects, Middletown, 1823, p. 484.

The first case, reported April 4, 1904, occurred in the northwestern outskirts of the town, but previously three examples of the malady had been observed at the Hartford Hospital, although they were not then so diagnosed. Following these cases many persons were stricken with the disease, and its epidemic nature soon became thoroughly established. During the two succeeding years 145 cases were reported, most of them occurring during the first three months of the epidemic. If we tabulate the cases as reported, we note during 1904: 2 in March, 45 in April, 45 in May, 19 in June, 4 in July, 1 in August, 2 in September, 3 in October, 2 in November, and 2 in December. In other words, 92 of the cases were observed during the first three months, and 125 of the 145 cases during the first year. In 1905, 2 cases were seen in February, 8 in March, 3 in April, 2 in May, 1 in August, 1 in September, 1 in November, and 2 in December. A few scattering sporadic cases have subsequently been noted almost down to the present time.

Of the 145 cases, 90 were males and 55 females. As to age, the distribution was: one to ten years, 86 cases; eleven to twenty years, 35 cases; twenty-one to thirty years, 8 cases; thirty-one to forty years, 8 cases; forty-one to fifty years, 2 cases; fifty-one to sixty years, 3 cases; sixty-one to seventy years, 2 cases; seventy one to eighty years, 1 case. Or classified thus: from birth to five years, 56 cases; six to ten years, 30 cases; eleven to fifteen years, 18 cases; sixteen to twenty years, 17 cases; twenty-one to twenty-five years, 5 cases; twenty-six to thirty years, 3 cases; thirty-one to thirty-five years, 6 cases; thirty-six to forty years, 2 cases; forty-one to forty-five years, none; forty-five to fifty years, 2 cases; fifty-one to fifty-five years, 1 case; fifty-six to sixty years, 2 cases; sixty-one to sixty-five years, 2 cases; sixty-six to seventy years, none; seventy-one to seventy-five years, 1 case. Thus we see most of the cases occurred in the first two decades—120 in all—and that more are recorded from birth to five years than during any other period. Of the total number (145), 108 died, giving a mortality of 74.48 per cent.

Geographically, most of the cases came from the east side of Hartford, where the population is the densest and largely made up of the lower classes, including the foreign element. Here the hygienic surroundings are frequently at fault. Twenty-two streets had more than one case, and in thirteen streets the cases were near one another, though some were on opposite sides of the street. If we tabulate the cases according to streets, we find one street (Front) had 13 cases, one street (Park) had 6, two streets (Spruce and Main) had 5, three streets (Smith, Liberty, and Talcott) had 4, six streets (Affleck, Avon, Charles, Kilbourn, Market, and Pleasant) had 3, and nine streets (Blumenthal Place, Broad, Buckingham, Chapel Howard, Hudson, Marsh Court, North, and Union) had 2. In eleven instances one house furnished more than one case, and in six of these the cases appeared in the same family, but in only one of the

six were there more than two examples of the disease. In this instance four were stricken. In one of these six a girl in the tenement above also came down with the malady. In the other five examples it was seen in those occupying the same tenement. All of the cases save one were in children.

Of the above cases, not sent to the Hartford Hospital, there were 35 which were seen by Dr. F. T. Simpson. He has kindly furnished us with a tabulated list of symptoms, from which we note that 21 had stiff necks, 2 herpes, 15 a petechial eruption, 24 showed Kernig's sign, and in 12 the pupils were dilated (in 2 the dilatation was unequal), while in 2 the pupils were contracted. Diplopia was seen in 2 instances. Of the total number, 25 were in stupor when seen, and 17 were occasionally delirious. All of them complained of headache, 5 of nausea; in 18 there were attacks of vomiting; 11 had chills at the onset, and in 4 convulsions were observed. There were only 8 recoveries.

Fifty-five of the patients were admitted to the Hartford Hospital, and were studied as carefully as possible during the time at our command. Of this number, 37 died, giving a mortality of 78.18 per cent.

Incidence. There were 33 males and 22 females. As to age, the distribution showed: one to ten years, 18 cases; eleven to twenty years, 17 cases; twenty-one to thirty years, 8 cases; thirty-one to forty years, 8 cases; forty-one to fifty years, 1 case; fifty-one to sixty years, 1 case; sixty-one to seventy years, 2 cases. Or, classified by five years: from birth to five years, 7 cases; six to ten years, 11 cases; eleven to fifteen years, 9 cases; sixteen to twenty years, 8 cases; twenty-one to twenty-five years, 5 cases; twenty-six to thirty years, 3 cases; thirty-one to thirty-five years, 6 cases; thirty-six to forty years, 2 cases; forty-one to forty-five years, none; forty-six to fifty years, 1 case; fifty-one to fifty-five years, 1 case; fifty-six to sixty years, none; sixty-one to sixty-five years, 2 cases. Here, as in the total list recorded from Hartford, most of the cases are seen during the first two decades—35 out of the 55 cases—but from birth to five years, the number, proportionately, is somewhat less. This we may explain as due to the fact that some of the cases reported to the Board of Health may have been erroneous diagnoses, and also because the parents would naturally be unwilling to part from their offspring, for hospital treatment, at so tender an age. The oldest patient was sixty-four years old, while the youngest was eleven months. In 2 instances the disease was seen in negroes.

Months. As the cases reported to the Board of Health occurred mostly during the first three months of the epidemic, so we find the hospital cared for the majority of the patients with this malady during that period, when only 4 recovered. In March, 1904, 2 cases were treated; in April, 11; in May, 15; in June, 6; in July, 3; in August, 2; in September, 1; in October, 1; in November, 1, and in

December, 2. During 1905, in February, 2 patients were treated; in March, 4; in April, 2; in September, 1; in November, 1, and in December, 1.

Occupation. Besides the cases seen in schoolchildren, it was found among the laboring classes, for machinists, toolmakers, blacksmiths, drivers, tobacco sorters, pack pedlers, electricians, brakemen, clerks, sailors, and dressmakers were attacked. We know of no examples reported from the well-to-do classes during this epidemic.

Etiology. Of the 55 cases, lumbar punctures were performed in 51, and in 43 of these meningococci were found in smears made from the centrifuged sediment of the fluid removed. The organisms were mostly intracellular and decolorized by Gram. In the very severe cases they were apt to be especially numerous, as many as fifty pairs being seen in one case. In three of the cases there were "dry taps," but in one of these the meningococcus was subsequently cultivated from the spinal fluid at the autopsy. In the five remaining cases the smears were negative, but the cases were all advanced save one. In one of the advanced cases, several lumbar punctures had been earlier performed, from which the meningococcus had been grown; in another, although the smear was negative, yet the meningococcus was later cultivated from a smear of the centrifuged sediment, made on blood serum. Tabulated according to the stage of the disease, 4 lumbar punctures were performed on the first day, 9 on the second day, 9 on the third day, 11 on the fourth day, 5 on the fifth day, 2 on the sixth day, and 2 on the seventh day. In one case the exact day could not be determined, and in eight instances punctures were made later than the seventh day. In one of these the meningococcus was found in the smear, but not in the culture; in another, it had elsewhere been cultivated, in two it was both seen and cultivated, and in three was neither seen in the smear nor cultivated. These last three were very light cases, and recovered. Of the 42 punctures made on the patients during the first week of the disease, the meningococcus was seen in the smear in all but one case (a dry tap), and in 36 of them this germ was cultivated, but in 2 of them it was not grown until autopsy. In 14 cases two punctures were performed, and in 5, three. From all but three lumbar punctures, from 2 to 65 c.c. were withdrawn. The fluid was clear, slightly cloudy, or of a thick, yellow color. The exudate in all was largely composed of polymorphonuclear cells; a few mononuclears were generally present, and, more rarely, some large epithelioid cells. As the disease progressed, in favorable instances, the polymorphonuclear leukocytes diminished in numbers, while the other varieties of cells became more numerous. In each case the fluid was collected in sterile test-tubes and examined after it had been allowed to settle for a short time. If the examination then was negative, the fluid was centrifugalized under antiseptic precautions and again examined. At each puncture if enough fluid

was obtained, from 2 to 3 c.c. was run directly into two or three tubes of blood serum, according to the method which Councilman, Mallory, and Wright recommended in 1898, and which Kalberlah has more recently advocated. If by smear the meningococci seemed very few, cultures were also made on blood serum from the centrifugalized sediment. Thus we were able to grow the meningococci in 39 out of the 43 cases from which fluid was obtained. Agar-agar, blood serum, ascitic agar, potato, and bouillon were the media generally employed, and on all the growths were quite characteristic, save that we were never able to detect a pellicle on our bouillon cultures.

In 5 instances we made blood cultures, twice from blood received from the same patient, but in only one of these did we succeed in obtaining any growth. On this occasion we found in pure culture a meningococcus, which grew characteristically on the above mentioned culture media. For these blood cultures, 5 c.c. of blood was withdrawn from the median basilic vein and distributed evenly into two Erlenmeyer flasks, each containing 50 c.c. of bouillon. Smears and cultures were taken from the nose in 41 cases. In 17 of the smears a diplococcus was seen, not decolorized by Gram; in 5 a diplococcus was decolorized by Gram; in 10 a staphylococcus; and in 7 there were very few organisms, with no preponderating type. In one of these a large undifferentiated bacillus was seen, while another showed diphtheria bacilli, which quickly disappeared after the use of antitoxin. Of the cultures, in 20 cases Staphylococcus pyogenes albus alone was obtained; in 7 cases the albus with the aureus was grown; in 7 cases the albus with a diplococcus, which decolorized by Gram and grew on blood serum as a thick pultaceous growth; in 1 case the pneumococcus alone; in another, the albus with the pneumococcus; in 2 cases, diplococci decolorizing by Gram with undifferentiated bacilli; in 2 cases this diplococcus with the aureus, and in another case an undifferentiated bacillus. All of the diplococci which decolorized by Gram presented on the different media the same cultural characteristics, and were evidently Micrococcus catarrhalis. Unfortunately, we were unable to devote as much time to the study of the nose cultures as we had planned to, so only one culture was made from each patient. In 6 cases there was a watery eye discharge, and in 4 one from the nose, but in none of them were we able to grow the meningococcus. Three smears showed diplococci decolorizing by Gram, and some of them were intracellular. In the case from which we grew the meningococcus by blood cultures bloody urine was withdrawn on two occasions by catheterization. This urine contained a diplococcus decolorizing by Gram, which we were unable to cultivate.

During the epidemic but 12 possible examples of contagion were noted. Most of them occurred in the practice of Dr. F. T. Simpson. We give them, along with those observed among the patients treated at the Hartford Hospital: (1) Two brothers slept in the same bed

on the night of April 4, 1904. On the following day one of them developed the disease, while the other was attacked four days later. (2) In another instance, two brothers slept in the same bed on April 7, 1904. The next day one was taken sick with epidemic cerebrospinal meningitis, while the other succumbed four days later. (3) Still another example relates to two girls who lived in the same house, in adjoining rooms. They were constant companions and played together April 21, 1904. The following day one came down with the disease, while the other was stricken with it seven days later. The two eventually recovered. (4) A fourth example was seen in a brother and sister, who were attacked one after the other, the interval being thirty-six hours. Both died within twenty-four hours. (5) In the fifth instance, a girl had a very light form of the disease, from which she recovered in ten days. Four days later her younger sister was taken ill with headache, vomiting, and stiffness of the neck. The symptoms lasted about four days and ended in an uneventful recovery. (6) A boy played on the piazza of a schoolmate's house, and next day was taken ill with this disease. One week later his friend, upon whose piazza he had played and with whom he had played, was suddenly stricken with this malady, and shortly thereafter died. (7) A male nurse, who had attended a boy ill with a chill, vomiting, headache, fever, delirium, a petechial eruption, and a tender spine, went to his own home on a Monday. Four days later his own son fell ill with the spotted fever and died the day following. (8) One of the hospital patients came from Park street, and was one of two in a family, who died of this disease. The following is the interesting chain of events: The mother of two children in a family on Smith street attended the funeral of one of the early fatal cases on Chapel street. Subsequently the two Smith street children played with two children of a family living near them, on Park street, and finally themselves contracted the disease four days after the funeral of the Chapel street case. Five days after the Smith street children were affected, the Park street children came down with this malady, and a little girl in the tenement above this last family was stricken two days later. Eventually only one out of these five children survived. (9) The ninth instance records a boy recovering from cerebrospinal meningitis in a house where, later, another person, a subsequent hospital patient, contracted the affection some three weeks after it was observed in the boy. (10) In this case a hospital patient came down with the disease while living in a house on Front street, where, three weeks later, a girl had the same malady, but soon recovered. (11) A hospital patient, a schoolgirl, had, as her constant companion and schoolmate, a friend who walked home with her on the day before she was taken sick, and received from her a violet. This violet the school friend put in her mouth, and, on parting with the subsequent hospital patient, kissed her good-bye. That night the latter developed meningitis, and

died the following day, fifteen minutes after admission to the hospital, while the other girl fell ill three weeks later, and died the day following. (12) The last patient in the series treated at the Hartford Hospital was taken ill on December 15, 1905, but his brother had contracted the disease a week previously. Both of them had occupied the same room, and in both the malady was fatal.

On the other hand, there were a number of families in this epidemic, among whom but one example of the affection occurred. One hospital case, a girl, aged five years, had four brothers and sisters, aged sixteen, thirteen, and five years, and seven days old, yet she alone had the disease, which was not prevalent in that neighborhood. If we can rule out a common source of infection, these examples merely point to the fact that epidemic cerebrospinal meningitis is only mildly contagious, thus bearing out the experience of former epidemics.

Morbid Anatomy. Autopsies were performed upon 7 of the 37 fatal cases. Six were men and one a woman. In the most acute case death occurred early on the second day; merely congestion of the bloodvessels of the pia-arachnoid was found. Four other cases showed this congestion very well, but also exhibited a marked purulent exudate following the course of the bloodvessels. In the remaining two cases (death on the sixty-second and three hundred and thirteenth day) no purulent exudate was noted, but the pia-arachnoid was very much thickened and injected. Numerous opaque areas were seen over the brain's surface. In one of the cases there was a slight area of softening in one of the temporal lobes. The exudate was generally more marked at the bases of the brains. With the exception of the very early cases, the spinal cords in the other acute cases were much injected and the bloodvessels were very tortuous. The purulent exudate was more likely to be found on their posterior surfaces, especially in the dorsal and lumbar regions. The spleen was enlarged in only one instance. In 4 cases there was marked pulmonary œdema, and in 2 the lungs were much congested. Chronic interstitial nephritis existed in 3 cases. Old infarcts in the kidneys, spleen, and brain were seen in 1 chronic case, which also showed a slight cerebral hemorrhage over the motor area of the right arm. Cultures and smears were made from the brain and cord of all these cases, except 2, and in the 5 Diplococcus intracellularis meningitidis was recovered. This organism was also found in the celloidin sections showing the exudate and brain substance. Lack of time has prevented us from studying the tissues from the autopsies more thoroughly.

Mode of Onset. A rapid onset was found in all but 7 of the hospital patients. Here there were several days of prodromal symptoms, which, in 3 instances, resembled typhoid fever, and in 1 other, influenza. Most of the school children affected had retired in good health the night before they were stricken, only to become victims of the disease with alarming suddenness during the night.

In the adults, there was generally more warning, but the following 5 histories evince the opposite: (1) One of the early patients complained of a chill one morning on awakening, and early went to the drug store for some quinine. Nothing more was known about him at his boarding house until 3 A.M. the following morning, when some of the people in the house were aroused by a noise in his room. Without ascertaining the cause, a doctor was sent for, who found the patient lying on the floor of his room wildly delirious. He was taken to the hospital, but survived only a few minutes on reaching the ward. (2) Another man was apparently well the day previous and able to do his work. The next morning his landlady found him in a comatose state, breathing stertorously. (3) A sailor, employed on one of the Hartford boats, was taken ill with cramps in the abdomen while on this way up from New York. He rapidly became unconscious and died shortly after reaching the hospital. (4) A man was brought by the city ambulance to the hospital unconscious, half an hour before his death. He had been found in a cheap lodging house, where he had been in apparently good health the previous day. (5) A Dane, aged thirty-five years, woke up early one morning with a chill; he then had a high fever, with extreme nausea and a headache. He did not vomit, but from the extreme suddenness of the symptoms was immediately sent to the hospital, as his doctor thought that he had taken poison.

SYMPTOMS. The most constant symptom at onset was headache. It was noted in 27 cases and was very intense, being usually located in the occipital region. In 7 there was vomiting (6 of the 7 were children), in 6 a distinct chill, in 2 chilly feelings, in 1 weakness in the legs, in 1 weakness and sleepiness, in 1 pains in the abdomen, 2 were feverish and fretful, 2 were in a stupor when first seen, 1 had a pain in his foot, 1 an aching of the bones of the extremities, 1 tonsillitis, and 1 a fainting attack. Twenty-eight of the patients were conscious on admission, but 4 of them were in a state of semi-stupor; while 27 were unconscious, 10 of them being wildly delirious. Twenty-seven showed varying degrees of retraction of the neck, 3 presenting marked opisthotonos; in 11 there was some stiffness of the neck and sensitiveness to pressure over the cervical vertebræ. Twelve cases showed general as well as spinal hyperesthesia. Kernig's sign was present in 48 out of the 51 cases in which it was sought (82.27 per cent.). In 1 instance it was found in the left leg, but not in the right. The reflexes, unfortunately, were not tested in every case. The records of the knee-jerks show they were absent in 8, exaggerated in 4, diminished in 5, and normal in 7. A positive Babinski reflex was never obtained. In 5 cases muscle tremors were observed, and in 9 (7 children) convulsions occurred during the course of the disease. In 1 patient it was the initial symptom. In another three convulsions were noted nine months after the onset of the disease, and all of them during the administration of $\frac{1}{30}$ grain of strychnine every

four hours. The strychnine was then discontinued, and no more convulsions were observed until about three days before death, when $\frac{1}{30}$ grain was given hypodermically, which again caused a slight convulsion and opisthotonos. Herpes was not a constant accompaniment, being noticed in 16 cases (29.09 per cent.). It was generally seen about the lips, but some cases showed extensive crops about the eyelids, cheeks, tongue, ear, neck, and back. An eruption was found on 43 of the patients (78.11 per cent.). It was a petechial rash in 28 instances, a pustular eruption in 1, in 1 a papular, in 4 purpuric spots were detected, in 5 rose spots, and 4 exhibited an erythema or a dusky mottling. The tongue was markedly coated in 20 patients. Vomiting, other than at the onset, was a constant symptom throughout the disease in 30 patients. Thirty-three were constipated during almost their entire illness, while in 11 diarrhœa was observed. Ten had retention of urine.

Cyanosis was a feature in 10 patients, in 1 of whom it was only noticeable just before death. Only 1 example of palpable spleen is recorded, although the area of splenic dulness seemed increased in 2 others. We are unable thoroughly to account for this small number. Possibly the inexperience of some of the internes in palpating but slightly enlarged spleens may partly explain it, for some of the patients died before the visiting physician saw them. The pupils were dilated in 29 cases, and contracted in 6 (later, they were dilated in 2 of these), unevenly dilated in 7, not dilated in 8, and not observed in 5. In 5 cases nystagmus was present, in 5 convergent strabismus, in 4 divergent strabismus; 4 had a bilateral ptosis, and 7 external strabismus. One had diplopia and another an ulcer of the cornea. In 8 cases there was a mild conjunctivitis. Ophthalmoscopic examinations were made on 5 patients; 3 were negative, while 1 showed optic nerve atrophy, with total blindness resulting, and the other a choroiditis. A suppurative or metastatic choroiditis of the right eye necessitated its enucleation in 1 case, in the ninth week. Nine cases had systolic murmurs over the cardiac area, which developed in 3 instances after admission to the hospital. The latter, with 2 other examples, were probably functional in origin. In 2 the murmur was due to a mitral insufficiency, and in 1 of them a fresh vegetation was found on the mitral valve at the autopsy. Unfortunately, no smear or culture was made from it. Arteriosclerosis seemed to account for the systolic murmur heard in a patient, aged sixty-four years. Arthritis was only once met with. It was seen in a woman, aged twenty-one years, on her admission to the hospital, and was accompanied by exudation. Its duration was about three weeks. One of the patients was a diabetic, as well as his father before him. Two vomited Ascaris lumbricoides during their illnesses. In one patient a peculiar fine branny desquamation on the face was seen during convalescence, sixteen days after the onset of the disease. Pneumonia was a complication seen six times; in 2 instances it was

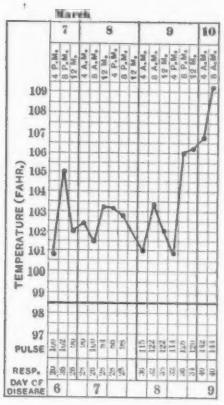
of the bronchial type. Death resulted in 4 of the 6. Seven patients had bronchitis during the course of the disease. In 1 paralysis of the left arm, and subsequently of the lower extremities, was seen a few days before death. Two showed on discharge a most marked mental impairment. Total deafness was the result in 2 cases. No other sequels were noticed.

Blood Examinations. Leukocyte counts were made of 48 patients, 45 of whom were in the acute stage of the disease. The average of these counts was 29,555. The highest, 70,000, was seen in a girl, aged five years. Thirty-four of them fell between 10,000 and 35,000. In 1 case 17 counts, and in 2 cases 15 counts, were made. These showed a gradual return of the leukocytes to normal as recovery ensued. It was not coincident, however, with the drop in temperature to normal. Following Draper's table, we give below the range in leukocyte counts: Under 5000, none; 6000 to 10,000, 4; 11,000 to 15,000, 4; 16,000 to 20,000, 9; 21,000 to 25,000, 4; 26,000 to 30,000, 9; 31,000 to 35,000, 8; 36,000 to 40,000, 4; 41,000 to 45,000, 1; 46,000 to 50,000, 1; 51,000 to 55,000, 2; 56,000 to 60,000, 1; 61,000 to 65,000, none; 66,000 to 70,000, 1.

Urine Examinations. Urine examinations were made on 42; the remaining patients came into the hospital practically moribund, and no urine was obtained for examination. In 28 out of the 42, albumin, with hyaline and granular casts, were found; 1 showed casts, but apparently no albumin, and 7 more showed the existence of albumin alone. In other words, all but 7 of the 42 cases showed albumin, and all but 13 showed casts. Five patients also revealed a trace of sugar, and another was a diabetic, whose urine contained 2.3 per cent. of sugar, with the additional presence of acetone and diacetic acid. During convalescence the casts and albumin cleared up in all the urines of the patients who recovered.

Types of Fever. Of the 55 cases we have temperature charts of 48. From a study of these we are thoroughly in accord with the statement made by former investigators that there is no typical temperature chart. In our series, although the fever does not seem to be proportional to the severity of the disease, yet we can resolve the cases into four groups, of which the first appears the most fatal: (1) The remittent fever type (Charts I, II, and III). In this class were 18 cases, and all but 2 of them were fatal. In 14 instances there was a rise of the temperature at death, the highest recorded being 109.4.° Most of those in this type (11 out of 18) died within the first six days of the disease. (2) The typhoid fever type (Charts IV and V). The cases here recorded showed a characteristic typhoid chart, with a fairly continuous temperature at first, then with more marked remissions in the later stages, and finally a return to normal, the duration of the disease varying from fourteen to four hundred and forty-six days. Twenty-two are placed here, of which number 11 died. (3) Pneumonic type (Chart VI), with the fever

rising rapidly, and, when the fastigium is reached, remaining fairly constant until the temperature falls by lysis within a few days. Six charts are of this type. Only one death resulted in this group. (4) The ascending fever type. This was seen in only one patient, in whom the disease made rapid progress, being fatal on the



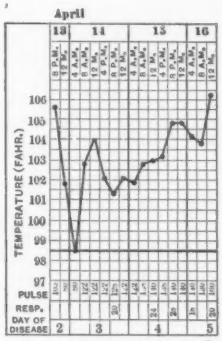


CHART I.—Remittent type of fever, with a high elevation at death (J. G., Case I).
CHART II.—Remittent type of fever, with a high elevation at death (L. C., Case III).

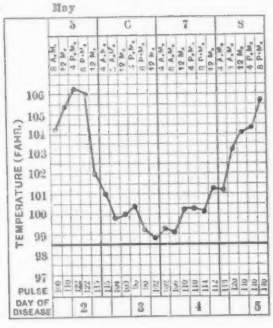


CHART III.—Remittent type of fever, with a high elevation at death (B. S., Case XIV).

second day. At death his temperature was 106.8° (Chart VII). The last patient was admitted during convalescence, with a normal temperature.

PROGNOSIS. The prognosis in no disease is illustrated more truly by the Hippocratic statement, that "experience is fallacious and judgment difficult," than in that of epidemic cerebrospinal men-

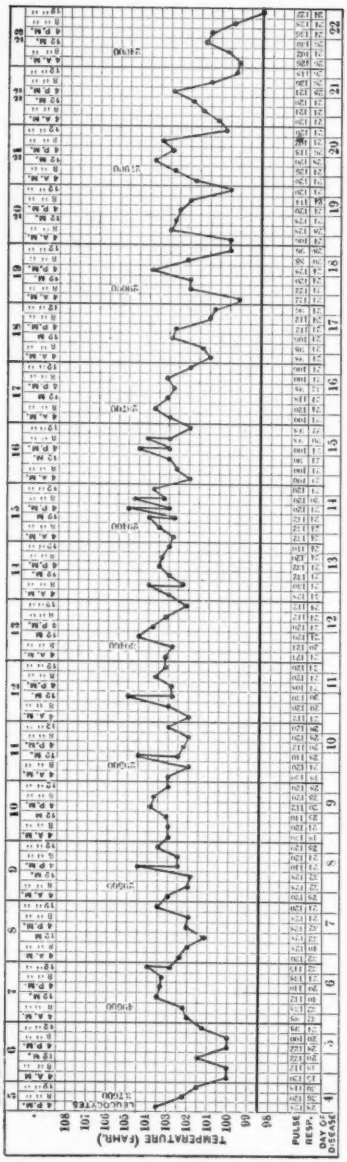


CHART IV.—Typhoid type of fever (J. F., Case XLIV).

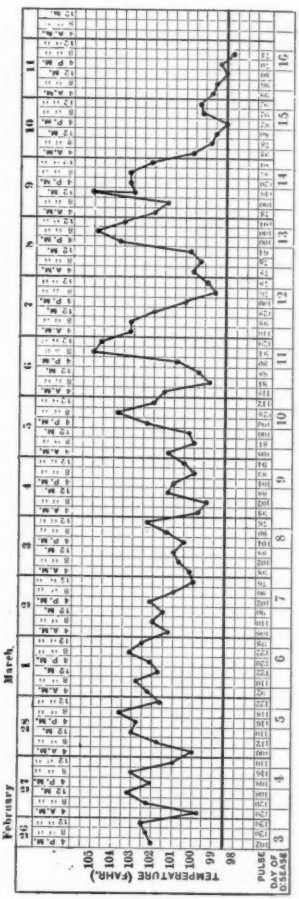


CHART V.—Typhoid type of fever (S. T., Case XLVI).

ingitis. Some of the sickest patients recovered (Figs. 1 and 2), while others, among those apparently least affected, rapidly succumbed. The mortality of the city cases was 74.48 per cent., while that of the hospital cases was 78.18 per cent. This is what we should expect, as the most severe examples of the malady are generally sent to a hospital. Indeed, a hospital's mortality in this affection is frequently higher. Of the hospital cases, 21 had an illness of less than six days, twelve hours being the shortest duration. The sojourn of the patients in the hospital varied from one day or less to four hundred and forty-six days. In 21 fatal cases death appeared to be due to the severe toxemia, while in 16 resulting exhaustion seemed to be the cause.

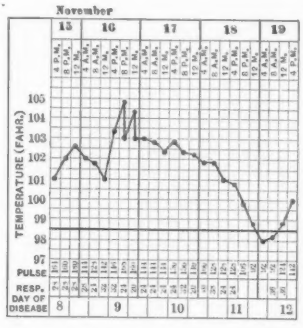


CHART VI.—Pneumonic type of fever (H. G., Case XLII).

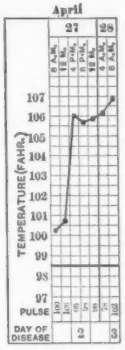


CHART VII.—Ascending type of fever (B. P., Case IX).

DIAGNOSIS. The diagnosis of the cases seldom caused any difficulty after the nature of the epidemic was recognized. The first three cases were, consequently, only later differentiated, as above mentioned. They presented extreme delirium, but had few other symptoms. Three, from their onset, rose spots, and temperature charts, resembled typhoid fever, but their Widal reactions were continuously negative, and their affections were subsequently proved to be epidemic cerebrospinal meningitis. One patient had a headache and malaise for three days, and was thought to be ill with grip. Feeling better at the end of this period, the patient got up, but soon had to return to bed, on account of the sudden onset of a severe headache. In another case, with but few symptoms and no Kernig's sign, a lumbar puncture first revealed the diagnosis.

TREATMENT. In no affection do we feel our limitations as much as in this disease. The list of drugs used is not commensurate with their vaunted healing properties. Hot baths and hot packs seemed, as first stated by North, to lessen the delirium and quiet the pain

more than cold applications. Lysol injections were given a brief trial and almost immediately given up, as we considered them an

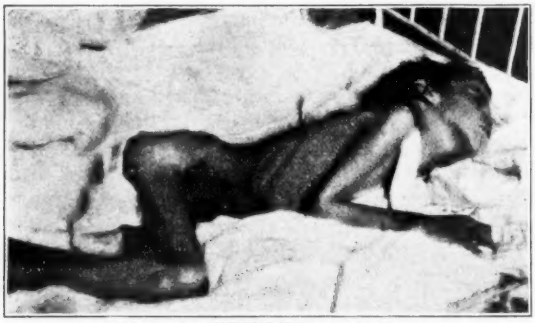


FIG. 1.—Case XXXVIII during the illness.

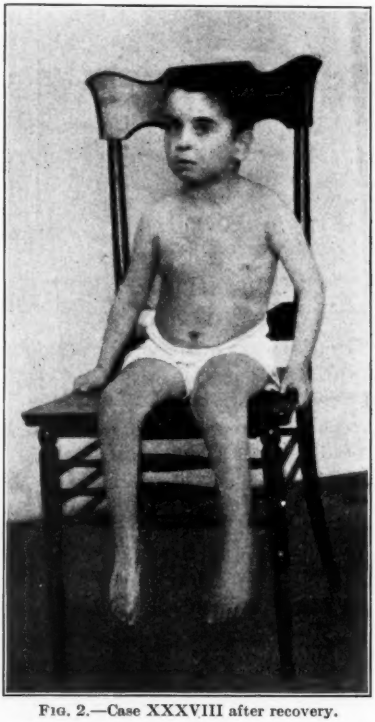


FIG. 2.—Case XXXVIII after recovery.

irrational procedure. Lumbar punctures in cases showing extreme headache, opisthotonos, and spinal hyperesthesia undoubtedly re-

lieved these symptoms momentarily by reducing the pressure of the cerebrospinal fluid. Antitoxin was employed in 5 cases, and the antistreptococcus serum in another without any apparent benefit. The best sedative seemed to be opium in some form. The use of chloral, bromides, ergot, and potassium iodide yielded no satisfactory results. Resort was had to surgery in 1 case, in which two lateral flaps were made in the cranium, hoping by this method to establish free drainage, but the patient died two days later.

In conclusion, we desire to thank the visiting physicians to the Hartford Hospital, as well as their assistants, for their hearty cooperation. We are also indebted to Dr. E. A. Wells, then assistant visiting pathologist and bacteriologist, for much assistance; and finally, and not the least, we are under obligations of the hospital internes for many acts of service.

TUMORS OF THE CAUDA EQUINA AND LOWER VERTEBRÆ.

A REPORT OF NINE CASES: SEVEN WITH NECROPSY, THREE WITH OPERATION.[1]

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The symptoms of tumor of the cauda equina resemble closely those produced by certain other conditions. The diagnosis must be made between hysteria, multiple neuritis confined to the lower limbs, intrapelvic tumor, tumor or caries of the lumbar vertebræ or sacrum, lesions within the vertebral canal but external to the dura, tumor or other lesion (hemorrhage) of the conus, and tumor of the cauda equina.

Hysteria. One of the most important symptoms of tumor of the cauda equina is pain in the lower limbs, severe in type, usually appearing first in one limb and later in the other, and more commonly simulating sciatica. Pain in the lower limbs may be distinctly hysterical. I have recently observed two cases of this character in which organic lesions as causes of the pain probably did not exist. A differential diagnosis usually is possible after careful study, but in certain cases it may be very difficult. In addition to the pain, weakness of the lower limbs may occur in hysteria.

[1] Read at the meeting of the American Neurological Association, May 7, 8, and 9, 1907.

MULTIPLE NEURITIS OF THE LOWER LIMBS. Neuritis is very seldom confined to both sciatic nerves and their branches, although it may be limited to the lower limbs, and I cannot agree with Müller[2] when he says that the upper limbs are almost invariably (fast regelmässig) implicated. I have seen neuritis confined to the lower limbs, but it is undoubtedly uncommon. Such neuritis does not usually cause great difficulty in diagnosis. The history of alcoholism or preceding infectious disease, or even when these factors are absent, the intense pain on pressure over the nerves and muscles, especially those of the calves, is very diagnostic, and there may be impairment of objective sensation and of motion; but pain on pressure over the limbs may occur in tumor of the cauda equina. The peroneal nerve supply is most likely to be affected in neuritis, but we recognize fully that isolated peroneal palsy occasionally occurs from intrapelvic lesions, and it is believed by some that the fibers forming the peroneal nerves are distinct from the other fibers in the sciatic nerve to their origin in the plexus of nerves in the pelvic cavity, and that they are more exposed to trauma within the pelvis than are the other fibers of the sciatic nerves. Bilateral peroneal palsy may occur from a lesion within the dura confined to the fifth lumbar and first sacral roots.

Bilateral sciatica is usually indicative of tumor. No diagnosis should be made with more caution than this of bilateral sciatica, and the condition is far too frequently regarded as merely ordinary sciatica in each limb. The prognosis should always be given with great reserve. Tumor of the pelvis, vertebræ, or cauda equina is often diagnosticated as sciatica which at first may be unilateral and later bilateral, and the condition in its commencement is the same as that of sciatica without disturbance of objective sensation and without motor paralysis.

Sciatica or multiple neuritis, even when the latter is in the lower limbs, is not usually associated with paralysis of the bladder and rectum, but the statement of Müller,[3] that this paralysis "noch nie beobachtet ist," is surely too strong. I should modify it by saying that it is very uncommon. I have seen multiple neuritis with implication of the bladder, and have a case under my care at present.

While tenderness of the muscles is usually indicative of peripheral neuritis, it has been observed in cases of tumor of the vertebræ and cauda equina, also in my cases II, IV, and V, and in the case reported by Sailer. In Schmoll's case of tumor of the cauda equina both sciatic nerves were exceedingly tender to touch. The condition is like the pain of meningitis. The posterior roots are greatly irritated, and any moderate peripheral stimulation is transmitted with unusual intensity. At least, this seems to me a reasonable explanation of the hyperesthesia of meningitis, and I do not regard the diag-

[2] Deutsche Zeitschrift für Nervenheilkunde, 1899, xiv, 1.

[3] Loc. cit.

nosis of a complicating neuritis as necessary. We can hardly assume that peripheral neuritis occurs in every severe case of meningitis, as we must do if we attribute the pain of meningitis to neuritis, as hyperesthesia is so common in meningitis.

Neuritis of the lower limbs is often confined to the territory of certain nerves, although it may be general.

The diagnosis between neuritis confined to the lower limbs and tumor of the cauda equina may, in the early stages of the disease, be exceedingly difficult.

Intrapelvic Tumor. A tumor of the pelvis may cause symptoms much like those of lesions of the cauda equina. The nerves forming the plexuses are more spread out in the pelvis than are the roots of the cauda equina, consequently an intrapelvic tumor may cause only unilateral symptoms, or at least symptoms confined to one side a long time, or preponderatingly unilateral, but the symptoms may be bilateral from the beginning if the tumor is medianly situated, or is multiple, or if the lesion is fracture. There may be the same pain and weakness either from tumor in the pelvis or in the cauda equina. Examination by the rectum or vagina is often useless in the early stages of intrapelvic tumor, as the new growth may be higher than the finger can reach, or may be too small or too flat to be detected. Later, when it has attained considerable size, it may be more easily palpated by the examining finger.

In a case seen by me in consultation with Dr. David Riesman, bilateral sciatica was for a long time the only symptom of intrapelvic tumor, and rectal examination was at first of no assistance in the diagnosis; later, the tumor grew to a large size and the diagnosis became easy.

The tenderness over the spine on pressure is not so likely to be present in intrapelvic tumor, but this tenderness has seemed to me rather an unreliable sign.

The motor and sensory symptoms usually occur more closely together in point of time in intrapelvic lesions than in caudal lesions, as in the pelvis both motor and sensory fibers are combined in the nerves, whereas in caudal lesions they are separate.

In pelvic lesions we expect symptoms indicative of implication of groups of fibers belonging to the lumbar and sacral plexuses, and not of one single nerve; still, we know that the peroneal nerve alone may be implicated in intrapelvic lesions. This is more likely to occur from trauma than from tumor.

In all the groups of cases under consideration the paralysis is flaccid, reaction of degeneration may be present, later atrophy may develop, and the tendon reflexes are diminished or lost, although it is possible to have some exaggeration of certain tendon reflexes when the nerves concerned in these reflexes are not implicated, and the neuritis is confined to other nerves even of the same limbs; or, in the early stage of neuritis, when the condition is one of irritation rather than degeneration.

In all these groups of cases the lesions implicate the peripheral segments (peripheral neurons), either the nerve fibers or nerve cells. When the lesion is above the lumbar region the clinical picture is a very different one.

The anesthesia of lesions below the cord proper (in the cauda equina, vertebræ, or pelvis) is not likely to be dissociated, as it may be in lesions within the spinal cord, but occasionally it is.

In plexus lesions, when the bladder and rectum are paralyzed, the power of erection and ejaculation is likewise usually impaired or lost, and yet a case of pelvic tumor reported by Müller[4] shows how difficult the diagnosis as regards these symptoms may be.

The pain was confined to the right lower limb one year. Three-quarters of a year after the beginning of the pain paralysis of the bladder and rectum appeared, and after the first year pain was felt in the left lower limb. The occurrence of vesical and rectal symptoms three-quarters of a year after the pain began Müller regards as contrary to the diagnosis of intravertebral lesion,and yet in one of my cases (Case II) of cauda equina tumor there can be little doubt that had the patient lived paralysis of the bladder and rectum would have occurred, even though it would have been months after the symptoms began. Much experience, Müller says, shows us that in lesions of the lower part of the vertebræ causing diminution of space the vesical and rectal nerves are first affected. This Case II of my series shows plainly that this statement is not always correct. Fibrillary tremors were present in Müller's case of intrapelvic tumor, and these are uncommon when the nerve cells are not involved. Although the bladder and rectum were paralyzed, erection was preserved, but ejaculation of semen was disturbed by paralysis of the ischiocavernosus and bulbocavernosus muscles. The fibers for erection, therefore, seem to rise higher in the cord and to leave the cord at a different level from those of the bladder and rectum, but the dissociation of these symptoms is certainly uncommon in lesions of the plexus. It is well to remember that it may occur, as demonstrated by this important case of Müller's.

Extremely interesting is a fact brought out by Müller, that the sensation of the lateral part of the scrotum is not from the coccygeal plexus, as is that of the median portion, but, like that of the testicles, is from the lumbar portion of the cord. Very little attention has been paid to this difference in origin of the fibers providing sensation to the lateral and median portions of the scrotum, but I have been able to confirm the correctness of the observation repeatedly.

TUMOR OF THE VERTEBRÆ. Here, as in all the tumors under consideration, pain is a very prominent symptom, and is likely to become bilateral sooner than in intrapelvic tumor. The posterior roots are caught in their passage through the intervertebral fora-

[4] Loc. cit.

mina, and the pain is usually constant, with exacerbations. Pressure over the lower vertebræ and sacrum may be exceedingly painful. It is impossible, in my experience, to decide from the symptoms whether the tumor is confined to the vertebræ or whether it extends also over the anterior surface of the dura. Of differential value in diagnosis from tumor of the cauda equina is the fact that the symptoms are likely at first to be confined to the distribution of a few nerve roots when the tumor begins in a vertebra, but that this is not always a reliable sign is shown by my Case II, in which the tumor was confined to the cauda equina, therefore was within the dura, and yet the symptoms indicated implication of only a few nerve roots. It is desirable to find some reliable means of clinical differentiation between tumor confined to the vertebræ and tumor on the dura or inside the dura without implication of the vertebræ. The former condition makes a radical operation impossible, although it does not forbid the attempt to cut posterior roots and relieve pain. A comparison of my Case II with Case IV is most instructive. In both pain was intense, with paralysis occurring after many months, and with no involvement of the bladder and rectum, and yet in the first the tumor was entirely within the dura, and in the other it was entirely extradural, and also in the verebræ.

Lesions of the Conus. The nerve tracts in the conus occupy a very small space, therefore when a lesion occurs in this part of the cord it is likely to implicate most of the tracts at nearly the same time. As a result paralysis of sensation and implication of the bladder and rectum occur almost simultaneously. If the lesions are strictly limited to the conus, which, following the lead of Raymond, may be recognized as beginning at the third sacral segment, we cannot expect motor paralysis except of the bladder and rectum, inasmuch as the limbs receive their motor supply from the lumbar and upper sacral segments. Pain is not usually a prominent symptom in conus lesions, unless the meninges or posterior roots are likewise affected.

Anesthesia in certain territories innervated by the lower sacral segments may occur in conus lesions and may be dissociated; it may even be bilateral from unilateral conus lesion, in that the buttocks near the anus, the perineum, and the external genitalia may be anesthetic on both sides. This bilateral anesthesia, so limited, is caused by involvement of the lowest posterior root fibers entering the conus on the side of the lesion and by involvement of the corresponding fibers from the opposite side after they have decussated in the conus.

When the lesion is confined to the conus it may by irritation of the adjoining upper region cause not only a zone of hyperesthesia above the anesthetic areas, but exaggeration of the patellar reflexes; yet this exaggeration of the patellar reflexes may occur from tumor of the cauda equina, as in Volhard's case.

Chronic meningitis confined to the lower part of the cord and

cauda equina has often been described, according to Schultze, and such a lesion causes severe pain, atrophy, and paralysis, not unlike symptoms of tumor. Schultze[5] excluded meningitis in one of his cases (Case VI) because the symptoms were progressive and in sudden increases, and not affected by antisyphilitic treatment.

Müller[6] thinks that in conus lesions the degenerative atrophy occurs more rapidly and intensely than in cauda equina lesions, because in the latter the nerve fibers are not so completely and so quickly implicated. This is a reasonable supposition. I must agree with Müller when he takes issue with Valentine regarding his statement that there is no improvement in conus lesions. Müller reports spontaneous improvement in one of his cases of cauda equina lesions, and this surely may also occur occasionally in conus lesions. Improvement in cauda equina lesions after trauma is not uncommon. Indeed, Schultze[7] has shown that Valentine's statement is not correct for all cases, as in three of his own cases improvement did occur, but the improvement seems to have been in the regions innervated from the lumbar cord. It is very true, I think, that improvement of the function of the conus in conus lesions is usually unimportant, because the transverse area of any part of the conus is so small that lesion in this part of the cord is likely to destroy the conus in its entire diameter, but it is also true that improvement is usually slight in cauda equina lesions so far as the functions of the conus roots are concerned. Certain symptoms may disappear, but the residual palsy is likely to be persistent.

Another of Müller's cases is worthy of note because of certain unusual features. He believed the lesion to be traumatic myelitis of the conus. The bladder and rectum were completely paralyzed, and yet erection and ejaculation were possible (potentia coëundi et gerandi), as the patient became the father of two children after the accident.

I have had a similar case as the result of injury, possibly to the cauda equina, from muscular strain, although the lesions may have been in the conus:

H. C., a male, aged thirty-one years, was injured eighteen months previously by a bale of cotton falling against the abdomen. He was unable to work about three weeks, but then returned to heavy work, feeling not quite so well as formerly. About a month after returning to work, while lifting a bale of cotton, he felt something give way in the right inguinal region, and at the same time heard a tearing sound. He immediately felt weak, and limped on the right lower limb, but walked home, a distance of about two blocks, and went to bed. After one day he got out of bed, but remained at home about a week. He then returned to heavy work, but has not been quite so strong as he was before the injury.

[5] Mitteilungen aus den Grenzgebieten der Medizin und Chirurgie, 1903, xii, 163.
[6] Loc. cit.
[7] Deutsche Zeitschrift für Nervenheilkunde, 1894, v, 247.

After the accident he lost control of the bladder, so that when he coughed or exerted himself urine would flow. The condition gradually became worse, until now he has no control of his bladder, and has been wearing a bag about a year. The sexual desire is not weakened, but he refrains from the sexual act because of the dribbling of the urine. He had sexual intercourse successfully six months ago without impairment of ejaculation and erection. During the past two months he has noticed that the rectal sphincter functionates weakly, and that when there is a call to stool it is urgent.

Present Condition. His gait and station are good. The lower limbs are well developed, but the man thinks he is weaker than he was before the accident. The left side of the scrotum, left side of the perineum, and the left buttock near the anus have fully normal sensation to touch and pinprick;[8] whereas the right side of the scrotum, except the upper outer portion, the right buttock, in a small area near the anus, and, to a less degree, the right side of the perineum, show diminution of sensation to touch and pinprick. The right side of the penis is less sensitive to touch and pinprick than the left side. He has no control of the bladder, but can control his bowels, except when they are loose. The sensation of the testicles is normal. The patellar reflexes are prompt. The Achilles reflexes are absent or slight. Babinski's sign is not present. The upper portion of the body is not affected.

Müller refers to a case similar to his own reported by Rosenthal, and also to a case reported by Bernhardt in which the bladder and rectum were paralyzed, although the sexual powers were preserved, except that the muscles for expelling the semen (the ischiocavernosus and bulbocavernosus) were paralyzed, that is, the condition, as Müller puts it, was potentia and libido coëundi with impotentia generandi, and he refers to a case reported by Schiff in which ischuria paradoxa and paralysis of the sphincter ani existed, but power of erection was retained. The loss of function of the bladder and rectum, with preservation of erection and ejaculation, is in favor of a conus lesion, but in my case the lesion probably was in the cauda equina, as the symptoms indicated probably unilateral injury, although a lesion of the conus cannot be excluded.

The conus may be injured, while the surrounding roots escape, as in the cases reported by Oppenheim, Schultze, and Sarbó.

Müller says he was unable to find any cases, with necropsy, of conus lesions without trauma.

Van Gehuchten,[9] from a study of the literature and of a case of lesion of the cauda equina and experimental work, believes that the bladder, rectum, and genital organs may retain their functions to a certain degree even when all the roots of the cauda equina, beginning

[8] A year later disturbance of sensation has been noticed on this side.
[9] Le Névraxe, 1903, iv.

with the fifth lumbar, are affected. He believes in the existence of a reflex centre for micturition, defecation, and erection outside the cord, but not for complete ejaculation of the semen. The restoration of micturition, defecation, and erection after trauma does not indicate that the conus is intact. The primary centres for these functions are in the hypogastric plexus of the sympathetic system; only the preservation of the anal reflex and of ejaculation indicates anatomical integrity of the conus and its roots. While primary centres for the functions mentioned are in the sympathetic system, other centres for them are in the conus, and are necessary for normal discharge of these functions.

I have had the opportunity to study a case of lesion of the cauda equina which bears out these statements. The disturbance of sensation is in the lowest sacral roots. By passing the urine and feces every three or four hours the man exerts a certain control over the bladder and rectum. The discharge is started by voluntary pressure of the abdominal muscles, but the man has no sensation from the flow of the urine, as the urethra is anesthetic. When the urine has nearly ceased to flow he is unable to stop the stream or to expel the last few drops. Erection occurs. There is, therefore, a certain periodicity in this case, but in another under my observation, in which sensory disturbances are also limited to the lower sacral roots, both cases resulting from injury to the end of the spinal column, the urine dribbles without the slightest control by the patient.

Warrington refers to the fact that Raymond has shown that a spinal lesion may cause incontinence of urine without any anesthesia, and Van Gehuchten, that in damage to the conus complete control over the sphincters may be preserved with the urine voided in a nearly natural manner while the mucous membrane of the urethra and bladder are absolutely anesthetic. Erection of the penis was preserved in Van Gehuchten's case, and this, Warrington thinks, is difficult to explain, inasmuch as the penis was absolutely anesthetic, and presumably the sacral centre had been completely destroyed. As he believes the preservation of control over the sphincters may have been due to the activity of the lumbar centre through its fibers to the sympathetic, it should not be difficult to explain the erection in the same way, as this is not always dependent on the sensation of the organ. Ejaculation of semen and forcible expulsion of the last few drops of urine depend on the contraction of the bulbocavernosus and ischiocavernosus muscles, and are always paralyzed if the lowest sacral part of the cord or the corresponding roots are damaged, according to Warrington. It would seem, from Warrington's statements, that these functions are not disturbed by a lesion of the lumbar centre. He refers to Van Gehuchten's statement that it is only with unimpaired capacity for these actions and in the persistence of the anal reflex that the diagnosis of integrity of the conus medullaris and of the corresponding roots can be made. The following

points, as Warrington[10] concludes from the writings of Raymond and Sippy, are in favor of a lesion of the cauda equina in distinction from one of the conus.

1. An insidious onset, with general development and progression of symptoms. A lesion in the conus is likely to cause a more rapid development of the symptoms.

2. Pain, violent in nature, spontaneous or excited by change of position or by movement, is in favor of root lesion, though moderate pain may be present in either condition.

3. Pain over the vertebral column below the level of the second lumbar spine exaggerated by percussion and radiating toward the lower limbs speaks for a root lesion. Warrington adds to this rigidity of the lower part of the spine from irritation of the nerves of the dura. Pain higher up, increased by pressure and not radiating very clearly over the lower limbs, is in favor of a medullary lesion. Lasègue's sign is indicative of a root lesion. Asymmetrical development is a radicular symptom, and is, perhaps, especially suggestive of an extradural lesion. My Case II shows, however, that one may be readily deceived in this sign. Remission of symptoms, especially amelioration in the condition of the bladder and rectum, and the slow appearance of muscular wasting, of the reaction of degeneration, and of trophic disturbance are, according to Warrington, in favor of an affection of the cauda equina.

Tumor of the Cauda Equina. The pain in cases of this type is often unilateral at first, but, as a rule, soon becomes bilateral, and yet it may remain unilateral many months. If the tumor develops at the lower end of the cauda equina, it will implicate the nerve fibers supplying the bladder and rectum, causing disturbance of function in these viscera, and disturbance in sensation in the region of the anus from the implication of the lowest sacral and coccygeal roots. This symptom-complex does not necessarily imply that the tumor is so low, because a new growth within the filum terminale near its origin from the cord may press at first upon those roots nearest to the filum, that is, the coccygeal and lower sacral, and cause the same combination of symptoms as when the tumor is considerably lower. This was well shown in the cases of Lachmann and Volhard.

In Lachmann's case of glioma of the upper part of the filum terminale the diagnosis of carcinoma of the bladder was made. The symptoms had existed two years, and began with incontinence of urine, paradoxical ischuria, and retention of feces. Later, digestive disturbances and emaciation developed. Hemorrhage into the bladder, especially with sudden return of the power to empty the bladder, strengthened the diagnosis of carcinoma, as in papilloma of the bladder catheterization by removal of the occlusion of the orifice may cause hemorrhage and return of the power to empty the

[10] Lancet, 1905, II, 749.

bladder. The necropsy revealed catarrh of the bladder, with swelling and injection of its mucous membrane.

A case of Cruveilhier, reported in his atlas, to which Lachmann[11] refers, shows, however, that a tumor of the filum does not always cause symptoms confined to the bladder and rectum. The symptoms were paralysis of the lower extremities, with contracture, and paralysis of the bladder and rectum. A tumor, which Lachmann thought the picture showed to be in the filum, was found. It was diagnosed as "encéphaloide."

A tumor of the filum, however, may exist without causing symptoms if it is not very large. I[12] reported a lipoma of the filum without any symptom caused by the growth, as the tumor had not attained a size sufficient to cause pressure.

Volhard's case is an exceedingly interesting one. The symptoms developed slowly (during four years), and began with disturbance in emptying the bladder and in sexual power, then dilatation of the bladder occurred with pyelitis, and dyspeptic symptoms, dryness of the skin and mucous membranes, and constipation. The muscular supply of the left sciatic nerve later became weak, and slight hypesthesia was detected in this region. The patellar reflexes were lively and the cremasteric reflex was present on both sides. The Achilles tendon reflex was weak on the left side and absent on the right side. Pain was not felt, and the only subjective sensory disturbance was a feeling of pressure over the sacrum. The absence of pain in this case, in which the symptoms persisted four years, was most extraordinary, and no similar case of cauda compression was known to Volhard, nor have I been able to find any, although tumor elsewhere on the spinal cord without pain has been observed. Operation was not attempted, as the patient's condition became too grave. The necropsy revealed a benign tumor of the cauda equina close to the conus, pressing the roots forward, and thereby injuring the motor roots most, as they were pressed against the bone, whereas the posterior roots were next to the soft tumor. A tumor lower in the cauda, Volhard[13] thought, could not have caused the symptom-complex. The weakness of the left lower limb seems to have been present about two years or a little more, and yet in all this time the right lower limb did not become weak; but a still slower development of the symptoms was present in a case of tumor of the cauda equina observed by Schultze.[14]

In this case pain was felt in the distribution of both sciatic nerves in 1885, and paralysis in the distribution of the right peroneal nerve in the end of 1886, but paralysis in the distribution of the left peroneal nerve did not occur until 1891, five years later. Vesical symptoms

[11] Archiv für Psychiatrie, xiii, 50.
[12] Journal of Nervous and Mental Disease, 1899, p. 287.
[13] Deutsche med. Wochenschrift, August 14, 1902, Nr. 33, p. 591.
[14] Mitteilungen aus den Grenzgebieten der Medizin und Chirurgie, 1903, xii, 163.

did not appear until seven years after the beginning of pain. Operation was attempted and a part of the tumor was removed, but the bleeding was profuse, much cerebrospinal fluid escaped, and the patient died on the eleventh day after the operation. The necropsy showed a large tumor of the cauda equina, an angiosarcoma myxomatodes, that had eaten its way through the bone.

A tumor may implicate both posterior and anterior roots, and for a long time cause only pain, usually in the hips, over the coccyx, and in the distribution of the sciatic nerve. The growth may be quite large, but it will still find space without causing a paralyzing pressure upon the nerve roots. A moderate degree of pressure is, however, sufficient to irritate the nerve roots, and this irritation will usually be shown first in the posterior roots, and therefore as pain, but there may be spasmodic twitching of the muscles of the lower limbs. The paralyses of motion and of sensation are usually later symptoms, and indicate that the tumor has attained considerable size. The paralysis may develop rapidly or within a few days, and in one of my cases of rapid paralysis (Case II) a blood cyst was found at necropsy. This cyst, with its well defined wall, could not have formed within so short a period before death, a few weeks. It is probable that a cyst existed in association with the tumor, and that hemorrhage into the former occurred.

Usually the development of symptoms in cauda equina lesions is very gradual, the symptoms beginning with pain and loss of reflexes in the lower limbs, followed often much later by paralysis and atrophy and anesthesia. The anesthesia is to be sought for especially in the perineum, external genitalia, and in a narrow zone about the anus, as this region receives its sensory nerves from the lowest roots of the cauda; and, although the tumor may not be at the exit of these roots through the sacrum and coccyx, it may exert pressure upon them near their exit from the cord, notwithstanding they are centrally situated in the cauda equina; but it is not true that these centrally situated roots are always first affected, as shown by my Case II, although Müller says it has been demonstrated that in high lesions of the cauda equina the most central nerve roots, those that arise lowest from the cauda, that is, the roots innervating the bladder and rectum, usually are first affected, and he refers to Lachmann in support of this statement; but this combination of symptoms by no means invariably occurs in high lesions of the cauda equina. In Lachmann's case the tumor was in the filum, and therefore in immediate relation with the lower sacral and coccygeal roots.

In determining the level for operation, the highest roots giving evidence of implication should be exposed.

A very interesting case of cauda equina lesion, reported by Müller,[15] shows how difficult the diagnosis between cauda equina and conus lesions may be:

[15] Loc. cit.

A man, aged twenty-two years, after carrying heavy weights, had severe pain in the lumbar region lasting two days. He then worked fourteen days, when the lumbar pains returned, were severe, and soon radiated into the lower limbs. These limbs, as well as the muscles of the trunk, rapidly became weak; the right lower limb, however, did not become weak until a few days after the left lower limb had become completely paralyzed. Then followed paralysis of the bladder and rectum. Weakness was present in the legs below the knees, but the feet were completely paralyzed. Reaction of degeneration was obtained in the back of the thighs, and in the legs below the knees, and ataxia in the heel-to-knee test was seen. Sensation was greatly affected in the distribution of the sacral roots. The patellar tendon reflexes and Achilles tendon reflexes, erection and ejaculation were lost. The pain indicated a cauda equina lesion, but the rapidity in the development of the symptoms, early cessation of pain, and the complete paralysis of the affected muscles indicated a conus lesion. Dissociation of sensation was imperfect over the scrotum and penis (impaired tactile sensation, loss of pain and temperature sensations), and bedsores developed rapidly; all this made the diagnosis of myelitis probable, but the cord was found to be normal, while the cauda equina was the seat of inflammation. This interesting case shows that at least an imperfect dissociation of sensation may occur in lesions of the cauda equina. Müller was unable to find any case in the literature like this one of his.

One reason why tumor of the cauda equina is likely to cause first sensory symptoms is that at the lower end of the cord the sensory roots are more numerous and larger than the motor roots, as shown by Müller.

When trauma is the cause of cauda equina lesions the symptoms may develop rapidly, as a fracture may implicate many nerve roots.

In the case reported by Laquer[16] pain, sharply localized to the middle of the sacrum, had persisted two years with pain on pressure in the same region. The rectus femoris muscle on both sides was weak and slightly atrophied. There had been transitory vesical and rectal paralysis. The tendon reflexes of the lower limbs were diminished. The sexual functions were impaired. Lumbar kyphosis was present. On account of the great pain by pressure over the sacrum the diagnosis of tumor was made, not within the dural sac, but outside the dura or within the sacrum. Every symptom of bone disease, swelling, displacement of the sacrum, was absent, and disease of the pelvis was considered improbable; therefore the conclusion was reached that the tumor was within the sacral canal. An intradural tumor implicating the cauda equina was considered improbable, as extensive motor, sensory, and trophic disturbances were absent notwithstanding the long duration of the process, and

[16] Neurologisches Centralblatt, 1891, p. 193.

the vesical and rectal paresis was of short duration, except that slight ischuria remained. This case, however, clinically has great resemblance to my Case II, in which the tumor was within the dura.

The entire sacral canal was opened, and a tumor (lymphangioma cavernosum) was removed from about the middle of the sacrum. It was about the size of the little finger, extradural, and not united with the roots or dura, but pressing the dura and cauda equina forward. The pain had disappeared two weeks after the operation, and the patient left the hospital cured four weeks after the operation. The dura was not opened, and possibly the recovery was due to this fact. The case seems to have been a most successful one.

In Laquer's case the pain in the sacrum was intensified by coughing, sneezing, defecation, or by the dorsal position. The absence of pain on pressure over the sciatic and crural nerves was one of the points used in favor of the diagnosis of a tumor beneath the sacrum, but some of my cases show that this pain on pressure over the nerves may be present in cauda equina or vertebral tumors.

A very thorough report of a tumor upon the conus and infiltrating the cauda equina is given by Sailer.[17] A man had severe pain in his lower limbs for some time. His gait had been ataxic six months. The pain commenced in the feet, and in this the case is remarkable, and extended upward, and was more severe in the left lower limb. Diffuse tenderness was present in the lower limbs, and especially over the nerve trunks. The sciatic nerve was more sensitive than the others. Continuous pain and tenderness were felt in the lumbar region. The feet were œdematous. (This condition in Schmoll's case caused him to suspect involvement of the vessels, but exploration of the abdomen did not reveal any vascular obstruction.) Paresthesia was present in the lower limbs, but objective sensation was probably not impaired. The patellar reflexes were absent. The man was able to move his lower limbs, but they were wasted. Later, frequent micturition appeared. A melanotic sarcoma was found in the lumbar region at the necropsy, about one inch in diameter, lying upon the left side of the lumbar enlargement and cauda equina roots. The tumor extended downward to the conus. Its total length was 4 cm., its anteroposterior diameter 1 cm., and its lateral diameter 7 cm. in the widest part. A considerable mass of granular tissue infiltrated the cauda equina. Sailer discusses the rarity of this variety of tumor within the vertebral canal. The spinal cord in the region of the tumor was much enlarged.

In the case of tumor of the cauda equina studied by Schmoll[18] both sciatic nerves were excessively tender. The nerves became so tender that the patient could not lie on the back or abdomen, and to obtain relief was obliged to rest in a kneeling position. In order to

[17] Contributions from the William Pepper Laboratory of Clinical Medicine, vol. i, p. 129.
[18] Amer. Jour. Med. Sci., 1906, cxxxi, 133.

sleep he knelt on cushions and reposed his head on the bed. He had rectal crises, with extremely painful tenesmus.

The bilateral sciatica was of three and one-half years' duration, and the rectum was involved in the painful area without involvement of the bladder. During this period the symptoms had not increased, and were merely those of pain. This is a most extraordinary case in this respect, and affords a remarkable contrast to Volhard's case, also of long duration, in which pain was not felt. It resembles my Cases II and IV. It is not strange that Schmoll could not believe that the lesion was a tumor, and, as the man had pulmonary tuberculosis, he concluded that a slowly progressing inflammation of tuberculous nature was involving the nerves. An "intraspinal" gliosarcoma was found beneath the sacrum, banana-like in form, about 6 cm. long and 2 cm. wide. The statement is made that it was "beneath the dura mater, which formed the floor of the opening;" therefore, it was a tumor of the cauda equina. The patient died on the fourth day after the operation with meningitis and pneumonia.

Schmoll thinks that the interval in his case between the beginning of irritation of the posterior roots and of other signs of compression is the longest on record. The cauda equina at necropsy showed no signs of the longstanding compression. Motor symptoms appear to have been entirely absent, but they did not develop until after many months in my Cases II and IV.

In Valentine's[19] case a prominence was observed over the third to the fifth lumbar vertebræ. A small piece of tissue removed showed the tumor to be a small round cell sarcoma, but neither operation nor necropsy permitted a confirmation of the diagnosis. The two cases of tumor of the cauda equina reported by Sibelius[20] are interesting chiefly from a pathological standpoint.

Schlessinger,[21] in his work on tumors of the spinal cord, gives pictures of a glioma of the conus terminalis (p. 26) at the junction with the filum; of a small cell sarcoma attached to the nerve roots and reaching nearly to the cauda (p. 34); and of an endothelioma of the dura lying upon the cord, reaching to the beginning of the cauda equina, and apparently well defined (p. 39).

The preservation of the sexual functions, even when the sensation of the bladder and urethra is lost, is shown in a case reported by Valentini,[22] in which paralysis of the bladder, with ischuria paradoxa and anesthesia of the penis existed, but the sexual functions were almost intact, except that the ejaculation of the semen into the anesthetic urethra was not noted. Valentini concludes that the nerves controlling the sexual functions must be distinct from the sensory and motor nerves of the bladder and urethra, and other cases referred to in this paper fully justify this opinion,

[19] Zeitschrift für klin. Med., 1893, p. 246. [20] Homén's Arbeiten, Band i, Heft 1, 2.
[21] Beiträge zur Klinik der Rüchenmarks- und Wirbeltumoren, 1898.
[22] Zeitschrift für klin. Med., 1893, xxii, 245.

In Thorborn's[23] case, with symptoms of extensive lesion of the cauda equina, only a very small tumor, a fibrosarcoma about the size of a hempseed, was found on one of the nerve roots of the cauda equina, with no signs of diffuse inflammation. As Thorburn says, some other lesion must have existed. Operation was not attempted.

In a case of tumor of the cauda equina reported very briefly by Gowers,[24] operation was not attempted. Many nerve roots were involved in the tumor, which was a fibrosarcoma, and from the picture given by Gowers, it could hardly have been removed by operation.

As regards the level of the lesion, the important case of Schultze[25] must be borne in mind. He has shown that a fracture of the twelfth thoracic and first lumbar vertebræ, causing a spicule of bone to project into the vertebral canal in the median line, and thus involving the lower part of the lumbar swelling of the cord, may give a symptom-complex confined to the distribution of the sciatic nerves and lower roots of the cord, providing the upper lumbar roots, situated laterally at this level, are not implicated. In such a case Erb had made a diagnosis of lesion of the cauda equina not higher than the fifth lumbar vertebræ. A lesion, therefore, at the level of the first lumbar vertebra, if it injures the cord alone, may allow the function of the lumbar roots, except, perhaps, of the fifth lumbar, to be preserved; and cause the same symptoms as a lesion of the fifth lumbar vertebra; while a complete transverse lesion, as a tumor, at the level of the second lumbar vertebra, may implicate all the lumbar roots, as well as the sacral, and cause complete motor and sensory paralysis of all the nerve distributions of the lower limbs.

Surgical Intervention. The question of operation is an exceedingly important one in cases of tumor of the cauda equina. Laquer's case is the only one Volhard could find in 1902 of cauda equina tumor correctly diagnosed and successfully operated upon. He found only six cases of tumor high in the cauda equina, and in those the correct clinical diagnosis was not made.

In Laquer's case the tumor was on the outside of the dura, and the latter was not opened. It is not improbable that the success of the operation depended upon this fact. Selberg[26] reports (1904) a case of spina bifida, complicated by a lipoma, implicating both spinal cord and cauda equina. The tumor was removed. Recovery from the operation occurred.

In another case a sarcoma was found at operation compressing the cord and cauda equina. The opening in the vertebral canal was 14 cm. long. The portion of tumor removed measured almost 9 cm.; it was, therefore, a very large tumor. Hemorrhage during

[23] Brain, vol. x, p. 388.
[24] A Manual of Diseases of the Nervous System, second edition, 1892, vol. i, p. 546.
[25] Deutsche Zeitschrift für Nervenheilkunde, 1894, vol. v, p. 247.
[26] Beiträge zur klin. Chirurgie, 1904, vol. xliii, p. 197.

the operation was slight, but the pulse was feeble after the operation —84, and death occurred the same day in collapse. The symptoms were not proportionate to the size of the tumor.

It is evident that the most thorough asepsis must be maintained in operations upon the spinal cord, especially in the lower portion, and this often is difficult, as decubitus and eczema occur, especially over the sacrum, making the opening of the lower part of the spinal canal especially dangerous. The escape of cerebrospinal fluid probably is considerable in the first few days after the operation. Selberg suggests that the patient, after the operation, should be kept with the upper part of his body slightly raised, in order to lessen the danger of pneumonia, and he should lie on one side to prevent the urine running into the bandages. The abdominal position during the operation increases the danger of pneumonia. If this be true, it would be possible to operate while the patient is lying on his side. Selberg says we must acknowledge that only a small portion of spinal tumors are operable, on account of their character and position. The operable tumors are those of the membranes that have not implicated the cord, and are lipomas, fibromas, psammomas, echinococci, and exostoses.

In Sachs' 2 cases,[27] reported in 1899, operation was performed. In the first a tumor (alveolar sarcoma) the size of a small cherry was found adherent to the dura and bone, and compressing the cauda equina. As much as possible of the diseased tissue was removed. In the second case laminectomy of the second and third lumbar vertebræ was performed. A gelatinous mass (small cell sarcoma) was exposed invading the body of the third lumbar vertebra. The tumor was removed. It had compressed the cauda equina. Improvement was pronounced in both these cases, but in neither was the dura opened.

In Starr's[28] case the spines and arches of the second, third, and fourth lumbar vertebræ were removed. An endothelioma involving both the soft and hard tissues was found. The dura seems to have been left unopened. The patient was in a critical condition for two days after the operation, but later improved. The case was reported shortly after the operation.

In the case of tumor of the cauda equina, reported very briefly by Fraenkel,[29] operation was performed, and the patient reacted with difficulty. The tumor was a fibrosarcoma. "Certain symptoms improved after the operation." Death occurred two months later.

The case of tumor on the cauda equina and lower part of the spinal cord reported by Putnam and Elliott[30] has some features of unusual interest. The patient, a woman, had been operated upon for cancer

[27] Journal of Nervous and Mental Disease, 1900, p. 108.
[28] Ibid., 1901, p. 156.
[29] Ibid., 1903, p. 101.
[30] Ibid., p. 670.

of the breast, and the diagnosis was metastasis to the spinal cord. Removal of the spinal tumor was attempted. An incision ten inches long was made over the lower thoracic and upper lumbar region, and the laminæ of the last thoracic and first two lumbar vertebræ were removed. On opening the canal, a carcinoma was found immediately beneath the bone. It was removed as far as possible, and two nerve roots on each side at the level of the growth were divided outside the dura but within the spinal canal. The dura was not opened. Relief of pain from this operation was very marked, but death occurred after a few months. The authors had entertained the thought of dividing the spinal cord in order to relieve the pain.

In the case of tumor reported by Box,[31] the first, second, and third lumbar spines and arches were removed. The dura was red, pulpy, and thickened. The cord appeared to be normal when the dura was opened, but no tumor was found. A piece of dura examined microscopically showed inflammatory changes, with small areas of calcification. The operation was well borne and the wound healed well. Later, a prominence appeared in the neighborhood of the laminectomy scar. A necropsy was not obtained. The tumor was supposed to have arisen in the meninges or the vertebræ, and thereby to have caused root symptoms, which were bilateral from the beginning.

Warrington's[32] interesting case of tumor of the cauda equina was typical in its symptomatology. Operation was performed and a soft-looking tumor was found within the cauda equina. It bled very freely when the attempt was made to remove it, and only a part could be obtained. The tumor was an endothelioma, or hemorrhagic angiosarcoma. Improvement occurred, but symptoms began to return about the end of three months. When a second operation was attempted the tumor was found to have grown enormously and was two to three inches long. A number of posterior roots were divided. The patient made a good surgical recovery after each operation, although in each the dura was opened. The first operation was on September 2, the second about three months later, and death occurred in the following May. At the necropsy the original growth was found to be of very large size, and multiple growths were present in the pia along the whole length of the spinal cord. A similar growth was present in the angle formed by the cerebellum, pons, and medulla oblongata.

The pain in this case is worthy of special notice; it was increased by flexing the thigh on the pelvis (Lasègue's sign), but distinct pain on pressure was not felt over the muscles of the thighs or legs or at the points of Valleix.

Warrington, on referring to the literature on tumors of the cauda equina, says Dufour (1896) collected 21 cases; in only 1 had an opera-

[31] Lancet, 1903, II, 1566.

[32] Ibid., 1905, II, 749.

tion been performed, and this was successful (Laquer's case, to which I have already referred). At a meeting of the Neurological Society, on October 27, 1904, Warrington says Dr. Ferrier and Sir Victor Horsley showed a patient from whom a fibromyxoma compressing the conus and cauda equina had been removed with marked success.

In one of the recent cases of spinal tumor reported by Batten[33] a sarcoma was found at operation outside the dura extending along the left twelfth posterior thoracic root. It was removed. The dura evidently was not opened. The condition of the patient following the operation is not stated.

This review of the literature shows that operations on the lower part of the vertebral column for tumor have been rather discouraging. True, the number of operated cases is small. I leave out of consideration here the successfully operated case of spina bifida, complicated by lipoma, reported by Selberg, and others of this character are known. The conditions in spina bifida are not the same as in tumor of the cauda equina.

Death occurred following operation in the cases of Selberg, Schmoll, Schultze, and cases of my series, I, II, and IV, although in the latter the tumor was extradural. Operation was not attempted in the cases of Cruveilhier, Volhard, Valentini, Sailer, and of my Cases III, V, VI, and VII. It was of benefit in the cases of Sachs, Starr, Fraenkel, Putnam and Elliott, Ferrier and Horsley, and Warrington; but Warrington's seems to be the only case in which the attempt to remove a tumor of the cauda equina did not result fatally, and the amount of improvement in this case is questionable. Opening the dura where a tumor of the cauda equina exists seems to be a serious undertaking.

We should like to accept the opinion of Müller when, in discussing tumors, he says that the prognosis from surgical intervention on the sacrum and lumbar vertebræ is decidedly better than on the other vertebræ and cranium, but statistics are not yet sufficiently large to warrant this statement. In my own cases, when the tumors could be examined they were all of such a character that complete removal would have been impossible, and this seems to have been true of most, if not of all, recorded cases. The well-defined, almond-shaped fibromas or fibrosarcomas occurring frequently at higher levels of the cord are much less likely to develop in the region of the cauda equina. Volhard regarded the tumor in his case as a glioma, although it was external to the cord, but intradural. He expressed the opinion that the tumors of this region that have been described under various names are all of the same character, and possibly are congenital; but, so far as I can judge from my own experience, they are usually sarcomas, and very often infiltrate

[33] Lancet, 1907, I, 139.

about the roots of the cauda equina, or implicate the surrounding bone. The tumor in my Case II was a fibrosarcoma, but not like the sharply defined tumor of this character often found at higher levels of the cord.

If the prognosis at present is very gloomy, in operating for tumor at the lower part of the vertebral column, it may be possible at least to cut posterior roots in order to relieve pain. It is not easy to determine the individual roots presenting in the opening formed by the exposure of three vertebræ. When the dura is incised the roots appear in contact with one another and they cannot be traced except in a very imperfect manner to their point of origin in the cord, or to their point of exit through the dura. The uppermost roots presenting in the opening are, of course, the sensory, and by observing whether the roots pass toward the posterior or the anterior part of the cord it may be possible to determine whether they are sensory or motor. If the attempt is made to divide all the sensory fibers of any one root, it is probable that some motor fibers will be included and may be cut, but it is doubtless unnecessary to cut every sensory fiber of any one root in order to relieve pain.

The roots of the cauda equina descend far within the dural sac, but on leaving the dura they pass only a little way downward before entering the intravertebral foramina; the sacral roots, however, have a longer extradural course than the lumbar. Having determined the lumbar vertebræ, each root at the lower border of a lumbar vertebra has the same name as the vertebra immediately above it, and we may, therefore, recognize it, and by tracing its course into the dural canal the sensory fibers may be separated from the motor.

If the opening in the vertebræ is high enough to permit exposure of the end of the conus, the second lumbar root may be determined by finding the first root leaving the dura below the conus; in the adult this is the second lumbar root.

The sensory roots supplying the bladder and rectum are at the interior of the cauda equina, near the conus, and it may be possible to leave these uncut. In cases in which the bladder and rectum are not paralyzed great care should be taken in cutting posterior roots to avoid the roots to the bladder and rectum, as paralysis of these important organs is a most undesirable complication. A few cases in the literature in which the posterior roots of the cauda equina have been cut to relieve the pain of tumor are referred to in this paper. It is permissible only when the tumor is irremovable and the pain is intense.

ORIGINAL OBSERVATIONS.

CASE I.—The first case of tumor of the cauda equina which I have studied was in the service of Dr. Dejerine, at the Salpêtrière.[34] This case was reported in 1895 by Dr. Dejerine and myself, more, however,

[34] Comptes-rendus des séances de la Société de biologie, séance du 27 Juillet, 1895.

as an anatomical and pathological study. The tumor was a round cell sarcoma. The patient had had pain and paralysis in her lower limbs eighteen months, implicating chiefly the right side. The operation was performed by Chipault. The third, fourth, and fifth lumbar and first sacral vertebræ were operated upon, and the tumor was found within the dural sac implicating the roots of the cauda equina. Hemorrhage was profuse, and the operation was abandoned. Death occurred three hours later, and at the necropsy the lower vertebræ were found implicated by the tumor.

CASE II.—Mrs. E., about fifty years of age, was first seen by me August 7, 1906, in consultation with Dr. N. L. Knipe, at which time the following notes were made: Pain began in the left hip one or, possibly, two years ago, but at first occurred only occasionally. In February, 1906, the pain in the left lower limb began to be severe, and Dr. Cleveland was called to see the patient. In about two weeks after the pain had become severe in the left lower limb, it was felt in the distribution of the right sciatic nerve, but here it lasted only a few days. Dr. Cleveland, when he first saw the patient, regarded the pain in the left limb as sciatica, which it resembled. The pain has persisted until the present in the left limb. Mrs. E. has always had a tendency to constipation, but this has been more pronounced during the past year. She was catheterized during one or two months while in the Presbyterian Hospital in the spring of 1906, but not since, and the retention of urine was attributed to the patient being in bed. Whether or not it was a transitory paralysis of the bladder is uncertain. Pain has been felt since February, 1906, at the end of the spinal column deep in the tissues and extending upward to about the lumbar region, but not above this. Periods of improvement had occurred. The pain came on in attacks and was very severe, and was chiefly over the sacrum and coccyx, but she has had some severe pain down the front of the left thigh. Pain was seldom in the right lower limb. It was through the left hip, but not in the right hip.

Present Condition. She has no motor weakness, no atrophy, no objective sensory changes in the lower limbs, no points of tenderness over the sacrosciatic notch, or over the sciatic nerves in the limbs. Lasègue's sign is not present, as no pain is produced by overflexing either lower limb. The left patellar reflex is diminished; the right is about normal. The Achilles-jerk is weak, but present on each side. The patient has not been out of bed for months on account of the pain. She can move either lower limb freely.

Tumor was the diagnosis made by me at this time, but the absence of motor paralysis and the almost unilaterality of the symptoms made the diagnosis a guarded one. Multiple neuritis was possible, but the severe attacks of pain and the absence of tenderness to pressure over the nerves were not in favor of this diagnosis. Vaginal and rectal examination were advised.

Dr. Knipe informed me, on August 30, 1906, that the patient had had none of the agonizing attacks of pain since she was seen by me, but this was not unusual, as these attacks had in the past recurred after long periods of comparative comfort. Dr. John Hirst made a vaginal examination, but could discover no tumor of the pelvis, no enlargement of the sacral bone, and no other abnormal condition except a deflection of the uterus to the left side and adhesions on that side. He thought this might be sufficient to cause some pressure upon the sacral roots. The patient had been complaining of great soreness in the back, especially in both buttocks and thighs.

She was seen again by me October 23, 1906, in consultation with her physician, Dr. Cleveland, when the following additional notes were made: She has had severe pain in the right lower limb about two months, but the pain in the left limb has become less severe during the past few weeks; she has had pain down the front of each lower limb, as well as down the back of the limbs. The pain has been severe in each lower limb and like toothache. Both legs below the knees feel numb, and she has a sensation as of a band about the right ankle. Since last week she has become weak in her lower limbs, but was not so previously. She has had some rise of temperature a long time, and has cystitis with albumin and casts.

Present Condition. Sensations of touch and pain are normal in all parts of the lower limbs; sensation of touch is normal about the anus and vulva and in the perineum. She can flex each thigh at the hip very little, but has more power in the legs than in the thighs. The voluntary power at the knees, ankles, and toes is better than at the hips, but is not normal. The patellar reflex is lost on each side. She has no Babinski sign, and the plantar reflex on each side is uncertain, if present. The lower part of the sacrum may be more tender to pressure, but tenderness to pressure is present over the spine as high or higher than the lumbar region. She has no girdle sensation. The muscles of the calves are a little tender to pressure. As objective sensation was normal and micturition and defecation were not much, if at all, affected, it seemed to me that the tumor could not be within the substance of the cord, nor could it have destroyed any of the roots. It probably involved the lower lumbar and upper sacral roots chiefly.

She was examined by me again in association with Dr. Frazier, November 9, 1906. The following notes were then made: The movement of the toes is performed fairly well on each side, but not with normal force. She can flex the right ankle very well, but has very little power in the left ankle. She can raise the right knee from the bed better than the left. The voluntary power at the knees is less than that at the toes. She is very weak, also, at the hips. Sensations of touch and pinprick are normal everywhere, even in the perineum and around the anus. The patellar reflex and Achilles tendon reflex are completely lost on each side, even with reinforce-

ment. She has no involvement of the bladder and rectum. Pressure over the lumbar vertebræ gives more pain than anywhere else over the vertebræ. Movement of the lower limbs causes no pain in her spinal column.

Urinalysis. Cloudy, straw color, flocculent precipitate; neutral, 1008; albumin and sugar, negative. Under the microscope: a trace of mucus, a few white blood cells and red blood cells, a few mixed epithelial cells, few leukocytes, oxalates with triple phosphates.

Blood Examination. Hemoglobin, 90 per cent.; red blood cells, 5,440,000; white blood cells, 8960.

November 10, 1906, an operation was performed by Dr. C. H. Frazier. A horseshoe incision was made in the midline, with the base at the lower border of the first lumbar vertebra, exposing the structures from the first to the fifth lumbar vertebræ. Laminæ and transverse processes of the fourth lumbar vertebra were removed, then those of the third, and finally those of the second. There was no sign of tumor outside the dura. Nothing abnormal was observed, and no adhesions were found between the dura and the vertebræ. The dura was slit in the length of the opening in the three vertebræ. A blood clot was removed from within the right side of the dura, about one inch long, one-quarter inch wide and flat, and having a red gelatinous appearance. A soft, friable mass was seen connected with this clot, within the dura, more on the right side and opposite the body of the third lumbar vertebra. It was about one-half inch in diameter each way. The cord pulsated after the roots of the cauda equina were separated. Only a small quantity of cerebrospinal fluid escaped. All the tumor found was removed, but in pieces. There was no growth outside the dura. The dura was closed with three or four interrupted catgut sutures. The muscles were closed with continuous catgut sutures and the skin was sutured with interrupted silkworm-gut sutures. A cigarette drain was introduced down to the dura through a stab wound in the flap of the skin.

A day or two following the operation the pain in the lower limbs was intense, and weakness of these limbs was increased; but by the fifth day after the operation the pain was much less than before the operation, and the patient could draw up the lower limbs as well as before the operation, and move the left ankle and right lower limb better than before the operation. She died on the morning of November 25. The spinal cord was removed in my presence a few hours later. A cyst, almost empty, was found by the side of the lower part of the conus; it was about the shape and size of an almond and was ruptured at the lower end. The clot of blood removed at the operation probably came from this cyst. Some tissue was found within the cyst that looked like tumor, and a small mass of tissue, looking like tumor, about 2 x 4 mm. in size, was found on the roots where the tumor had been removed, that is, about opposite the third lumbar vertebra. No evidence of infection was detected.

The cyst (Fig. 1) extends within the roots of the cauda equina a half-inch upward above the termination of the conus, and is one inch long and half an inch wide. It does not implicate the roots of the lower part of the conus, and, probably because of this, the bladder and rectum escaped. These lowest roots are caught in the small mass of sarcoma tissue still remaining. The tumor is a fibrosarcoma.

In this case the pain began in the left hip. Müller says that the outer and posterior parts of the pelvis are supplied by the iliac branch of the iliohypogastric nerve and the lateral cutaneous nerve of the thigh, from the lumbar plexus (second or third lumbar,

FIG. 1.—Fibrosarcoma and blood cyst in the cauda equina. Vesical and rectal symptoms were not present, although the tumor was in the centre of the cauda equina.

according to his chart). Later, the pain was felt in the course of the left sciatic nerve (first and second sacral according to chart), and the right sciatic was affected temporarily and later permanently. This meant extension to the sacral roots. Still later, pain was felt down the front of each lower limb (fourth and fifth lumbar, according to chart). This part is supplied from the lumbar plexus. The patient had a sensation of numbness in both legs below the knees, therefore in the sciatic distribution (first and second sacral, according to chart). She also had pain at the end of the spine. This part is supplied from the lowest sacral and coccygeal (fourth and fifth sacral) roots. The weakness in the lower limbs meant involvement

of lumbar motor roots, and the greater power of the legs, as compared with that of the thighs, meant less involvement of the anterior roots forming the sacral plexus, than of those forming the lumbar plexus. Loss of patellar reflexes meant lumbar involvement also. Important was the escape of the nerves for the bladder and rectum (fourth and fifth sacral, according to chart), and absence of all objective disturbance of sensation. The symptoms pointed to a lesion beginning on the left side, then extending to the right side, and involving the second, third, fourth, and fifth lumbar, and first and second sacral roots, the posterior more than the anterior. Pain alone at the end of the coccyx suggested the involvement of lower sacral nerves, but the escape of the bladder and rectum showed that such involvement if it had occurred must be slight. The tenderness to pressure was not strictly localizing, as it was felt both over the sacrum and the lumbar vertebræ. It did not seem probable that the tumor was in the center of the cauda equina, as the bladder and rectum escaped. It might be a tumor on the outside and upper part of the cauda equina not affecting the innermost nerve roots (third, fourth, and fifth sacral and coccygeal; escape of bladder and rectum); this would be indicated by the involvement of the second and third lumbar, and, later, of the first and second sacral, and fourth and fifth lumbar. It must, if within the dura, be high enough to catch the second and third lumbar roots, and if so it could hardly be a very long tumor or it would extend downward far enough to catch the lower sacral roots; nor could it be a very large tumor, as, at the exit of the second and third lumbar, it would press upon all the roots of lower origin and cause paralysis of them; or, possibly, by extending upward, might press upon the conus, in which case paralysis of the bladder and rectum would be likely to occur. It might well be a tumor of the lower lumbar and upper one or two sacral vertebræ; this would explain the escape of the bladder and rectum and the extensive area of tenderness to pressure over the sacrum and lumbar vertebræ. The second and third lumbar roots could hardly have been involved at their exit from the cord, as the implication of the fourth and fifth lumbar and first and second sacral would imply in that case a large tumor, and this would probably cause pressure upon the cord sufficient to produce more impairment of function. It was evident that none of the sensory roots was completely destroyed, as even to the time of operation no objective disturbance of sensation was found. For localization in operation, the second, third, and fourth lumbar seemed to be the proper vertebræ. The blood cyst probably caused the rather rapid development of paralysis in the lower limbs.

Case III.—H. was seen by me July 31, 1905, in consultation with Dr. MacLeod and Dr. Edward Martin. He had also been seen by Dr. Alfred Stengel and Dr. Charles K. Mills. My notes, made July 31, 1905, are as follows: In the early part of 1905 he had a fall on

the ice and came down heavily on the buttocks. About three months ago he began to have pain in the lumbar region and down the left lower limb, following the sciatic nerve. In about four or five weeks the pain was felt in the course of the right sciatic nerve. The case was supposed then to be one of double sciatica, and the patient was sent to Hot Springs, Virginia. All venereal disease is positively denied, and the wife has had no miscarriages. While at the Hot Springs he found that the urine did not come promptly, and gradually retention developed, and he had to be catheterized, and his bowels became constipated. Then weakness of the lower limbs developed, and gradually became a complete paralysis. He thinks he has had some pain down the front of the thighs. Dr. MacLeod, of Bryn Mawr, who has been attending him, says that the patellar reflexes at first were very prompt. He has had no involvement of the upper limbs or of the face, but has had tachycardia; pulse, 130. He has lost flesh, is very pale and sickly looking. The paralysis of the lower limbs has developed within about three months. He has been taking 105 grains of potassium daily and as much as 6 ounces of mercurial ointment daily, and has stood this treatment well.

Present Condition. He has complete motor paralysis of the lower limbs, and cannot move the toes or the limbs at the hips. The patellar reflexes and Achilles reflexes are completely lost, even on reinforcement. The Babinski sign is not present, and there is no movement of the toes in either direction. The upper and lower limbs are emaciated. Sensations of touch and pain are lost below the knees and in the posterior part of the thighs, or, if not lost, are almost so; occasionally he seems to have a little sensation in the soles of the feet. Sensations of touch and pain are preserved in front of the left thigh, but are diminished, especially in the front of the right thigh, and are normal over the abdomen to the inguinal region, but are lost or nearly lost over the buttocks about the anus. There is some tenderness over the spine in the lumbar region, but no deformity of the spine. The cremaster reflex is lost on each side. Grasp of each hand is good. The biceps jerk on each side is prompt. The pupils are equal, and respond promptly to light. The facial nerves are not affected. The tongue and muscles of mastication are normal. The man remained in this condition, gradually losing strength, until his death, on September 30, 1905, 1 A.M. Necropsy was held by me September 30, 3 P.M.

The laminæ of the lower lumbar vertebræ were so soft they could be cut with a knife. The anterior portion of the dura was adherent to the bodies of these vertebræ, which also were soft. A mass of tumor tissue was removed, adherent to the anterior part of the dura. Numerous hard, bony-like masses were found in the roots of the cauda equina, and most of these were in the roots where they penetrate the dura; some were within roots in the dural cavity (Fig. 2). These masses, though hard, could be cut easily with a knife. No

tumor was found within the cord or within the abdominal cavity. The bedsore over the sacrum was nearly round and about four inches in diameter, and extended to the sacrum. Sores also were over both heels. The lower limbs were wasted.

The tumors both within and without the dura contain numerous calcareous areas resembling imperfect bone formation; within them are many round or oval cells, and in some places spindle-shaped cells like those of a fibroma. They have the appearance of an osteosar-

FIG. 2.—Osteosarcomas (indicated by lines) in the cauda equina.

coma. Calcareous deposits and sarcoma cells are found in one of the tumors of the nerve roots within the dura examined microscopically.

Sections from the lumbar segments stained with thionin show much degeneration of the cells of the anterior horns, chromatolysis, peripheral displacement of the nucleus, and loss of dendritic processes (Fig. 3). The posterior columns in sections from about the twelfth thoracic region show intense degeneration by the Marchi method. Some diffuse degeneration is present in the anterolateral columns, and the posterior roots from this level are much degenerated.

CASE IV.—H. H., aged fifty-five years, was seen by me in consultation with Dr. L. Loeb, September 4, 1905, at which time I made the following notes: He has been having pain in the right thigh about one year, and, although he has occasionally had pain in the left thigh, it has only been within the last two months that he has had severe pain in this thigh. The pain now is over each sacrosciatic notch and is excruciating and comes independently of any movement. Coughing or deep breathing increases the pain greatly. There is no implication of the upper limbs or head. Sensations of touch and pain are normal in the lower limbs. The patellar reflex is prompt on each side, and is shown not so much by jerking of the

FIG. 3.—Osteosarcoma in one of the roots of the cauda equina. The dark patches indicate calcareous deposits.

leg as by contraction of the quadriceps muscle, and it is prompter on the right side. Achilles reflex is not present on either side. There is no Babinski reflex, and the toes are not moved distinctly in either direction. There is no distinct tenderness to pressure over the muscles of the calf, thigh, or anywhere else; nor over the nerves, except, possibly, at the sacrosciatic notch. Some slight tenderness to pressure is felt over the lumbar region. The spinal column is not deformed. He has control of the urine and feces. There is no localized atrophy, although he has lost flesh generally. The pain seems now to shoot down the legs, following the sciatic nerves, and extends to the feet, and movements of the patient cause pain. The lower limbs have good voluntary power, and whatever apparent loss of

power there may be is probably because of the pain. The pain, by extending from the front of the thighs to the back, and in being bilateral, suggests pelvic tumor.

Additional notes were obtained from Dr. W. W. Keen.

December 5, 1906. In the summer of 1903 he fell about four or five feet while building a dam. His knees caught between some rocks and stopped his fall forward, and he fell backward, but did not strike the end of his spine or injure himself in any way, excepting that his knees were bruised by the rocks.

He had drunk quite freely in past years. About eighteen months to a year ago (a little longer than in the statement made to me) he began to suffer pain in the right sciatic nerve. Some months later in the left sciatic; later still, the pain involved the anterior crural, first on the right side, and later on the left side. He has had also some diffuse pain in both hips. The pain has been progressive, but has been worse of late on the left side. He has had some obscure sacral pain, but none in the lumbar region. About four or five weeks ago he began to lose power in the lower limbs, first in the right leg, then, about three weeks ago, in the left leg, after a severe attack of pain. The bowels and bladder have never been involved in any way. There is no local muscular wasting.

When Dr. Eshner first saw this patient about four weeks ago the patellar reflex on the left side was absent; on the right side it could just be elicited; both of these tests being with reinforcement. There was no plantar reflex. Babinski's sign on the left side was doubtful. Cremasteric and anal reflexes were normal. The man has never had any fever excepting two months ago, when for three or four days his temperature ran up to 103° from some temporary gastric disturbance. Bowels are regular. An *x*-ray photograph showed no alteration. There has been no loss of sexual power, but inability to perform the sexual act on account of pain.

Dr. Harvey Cushing, in examination of the pelvis, found nothing wrong. Dr. Keen found that the cremasteric reflex was elicited only on the inside of the thigh, but was quite well marked on both sides. The patellar reflexes were absent, and there was no Babinski reflex. The man could voluntarily draw up both legs well, the right more forcibly and quickly than the left, which moved feebly and after repeated efforts. He could stretch out both legs, the right better than the left. Examination of the back showed no tenderness in the lower dorsal, lumbar, or sacral region either upon pressure or sharp percussion with the fingers. Mercury and potassium iodide had been used to the limit of tolerance.

On December 9, 1905, a consultation was held with Drs. Mills, Eshner, Keen, and myself, at which time the following notes were made: In the left leg foot-drop is almost complete. Whether this was true four days ago Dr. Keen did not know. There is no Achilles-jerk on either side. Voluntary flexion and extension of the

toes and ankle on the right side are present, but, except in very slight movement of the toes, are absent on the left. The movements are very weak in the whole left leg. On the right side they are impaired, but much less so than on the left, and are worse below the knee than above. There is no anesthesia anywhere. On the dorsum of the left foot there is very slow appreciation, with slight diminution on the left thigh posteriorly. Sensation on the scrotum is normal. On passively moving the right leg considerable pain is felt in the sacral region. Moving the left leg, the pain is much more acute in both legs. It is especially elicited by flexing the leg on the thigh and the thigh on the pelvis with the thigh in abduction. Grasping the muscles of the anterior part of either thigh and compressing them elicits considerable pain on each side, but more on the left. Squeezing the foot on either side is especially painful, particularly so on the left. There is no pain or muscular disability in the arms. The back is rigid. The man was made to sit on the side of the bed, and this position produced marked pain in and about the right trochanter; in the joint, as he expressed it. The pain also extended over the right buttock and sacrum. The conclusion was reached that the lesion was probably either a neoplasm in the spinal canal, most likely in the cauda equina, or possibly a pelvic sarcoma, which, in consequence of the patient's large form and great stoutness, could not be detected. Laminectomy in the lumbar region was decided upon.

Operation December 10, 1905. Dr. Keen removed the laminæ of the first, second, and third lumbar vertebræ. The dura was divided the length of the wound. The tumor was not found. The temperature rose to 101° within a few hours after the operation, and fluctuated between that and 102° until he died at 1.45 A.M. on the 12th, about forty hours after the operation. Œdema of the lungs set in speedily after the operation, and the patient gradually lost consciousness. His pulse rose to 156, and later became uncountable. The necropsy was made by me.

A tumor was found on the anterior part of the spinal dura. It begins just above the exit of the second lumbar roots from the dura and extends to the exit of the third lumbar roots, and is more on the left side in its upper part, but not in its lower part. The cord appears somewhat swollen just below the portion exposed at the operation. The dura was adherent to the bodies of the vertebræ just below the part exposed at operation. The bodies of two or three vertebræ at the level of the tumor were soft and could be partly penetrated by the knife. The tumor seemed to have originated in the bodies of these vertebræ. The stitching of the dura ended just above the upper part of the tumor (Figs. 4 and 5).

The tumor contains round and oval cells and also spindle-shaped cells, with considerable fibrous connective tissues, and has the appearance of a fibrosarcoma. The nerve cells of the anterior horns

in the lower lumbar and upper sacral region show intense degeneration, peripheral displacement of the nucleus, chromatolysis, loss of dendritic processes, and vacuolation. The alteration of the cells is equally intense on both sides of the cord.

Sections from the fourth lumbar segment show intense degeneration of the left posterior column by the Marchi method, and of the posterior root fibers entering at this level, but only a slight degeneration of the right posterior column. The degenerated fibers are

FIGS. 4 and 5.—Extradural fibrosarcoma over the roots of the cauda equina. The stitching of the dura ends just above the tumor, shown as a mass of tissue on the outside of the dura.

found also in the left anterior horn. The degeneration by the Marchi method is very slight at the first sacral segment, but is more pronounced on the left side. It is more pronounced at the third sacral segment, and here also is greater on the left side, but is not nearly so great as at the fourth lumbar segment.

CASE V.—The notes and pathological material of this case are obtained from Dr. Charles K. Mills. S. D. C., aged sixty-two years, white, male, living at Kennett Square, Pennsylvania, was seen by

Dr. Mills in consultation with Dr. U. G. Gifford, March 15, 1902. He was well until August, 1901, when he first had pain in the back and along the distribution of the left crural nerve and the thigh. He gradually lost power in the left leg, and before this loss was complete the right leg also became affected, the loss of power gradually increasing until, by December, he was almost completely paralyzed in both lower extremities. He had more or less diffuse pain in both legs, but this was most marked in the anterior portion of the left thigh. Early in the case there was tenderness as well as pain in the distribution of the left crural nerve. In December, 1901, and January, 1902, he complained of much pain in all parts of the legs. This pain was not only subjective, but he had much pain on movement of the legs and trunk and also in spots on handling the legs. Taking hold of the legs about the ankle, for instance, would cause him to cry out with pain, and this without any movement of the limbs or body. Later, the pain on handling became less, but he continued to suffer with severe pain in the back, and also with pain which radiated from the back and down the limbs. From about the middle of December his bowels began to be inactive, and in a short time were completely torpid or paralyzed. Later, about the middle of February, incontinence of the sphincter ani came on, and he had at times involuntary evacuations. He never lost control of the sphincter of the bladder, nor were the bladder walls paralyzed, although he occasionally had some apparent difficulty in completely emptying the bladder. He was catheterized by Dr. Gifford, who found no residual urine. Sensation was retained, except, perhaps, on the inner anterior aspect of the thighs, where he was slightly hypesthetic. He had no girdle sensation.

When examined by Dr. Mills, March 15, 1902, the man was in bed on his back and unable to move without assistance. The movements of the thigh on the pelvis and extension of the leg on the thigh on the left side were completely lost; on the right side the conditions were similar, but the loss of power was not so complete. The anterior aspect of the left thigh showed marked atrophy, and no responses to the faradic or galvanic current could be obtained in the quadriceps and other muscles of this aspect of the limb. The same was true on the right side. The movements of the foot were preserved, but impaired, and this was especially true on the left side, that is, he could dorsally flex, extend, adduct and abduct the foot and perform various movements of the toes, but these were impaired and somewhat uncertain, especially on the left. The muscles below the knee were somewhat wasted, but not distinctly atrophied, and responded to the electric current, but there was some quantitative diminution. Sensation was retained, except the slight partial loss over the anterior aspect of the thigh, where the responses were somewhat uncertain. The bowels and bladder were as above noted. Knee-jerks and quadriceps jerks were abolished; no clonus was obtained; he

had the Babinski reflex on the left side, and on the right side there was no reflex movement of the toes. At this time the man still complained of much pain in the back and at times of pains radiating to the groin and into the limbs. He was not tender to pressure over the nerves of the extremities, and pain was not caused by lateral squeezing or other manipulations of the foot. The spine was rigid, all movements being restricted. Jarring caused some pain. Percussion and deep pressure caused pain over the position of about the second and third lumbar vertebræ, where there was a slight deformity. He had no symptoms above the waist line.

The movements of the right foot and leg were as noted at the time of this examination, but a few weeks previous to this the loss of power had been greater, and was then somewhat more marked on the left side. Under treatment he had regained in part the movements of the foot on the left side, but no improvement took place in the muscle groups above the knee.

About the 16th or 17th of the month his temperature began to rise; he had frequent and profuse sweating; he sank into a torpid and eventually into a typhoid state; at times he was delirious; he gradually became weaker, and died March 25.

The necropsy was held ten hours after death by Drs. Gifford, Reynolds, and Darlington. In opening the spine the left transverse process over the third lumbar vertebraæ was seen to be necrosed. It was loose and dropped out; no pus was present. The posterior arches were removed from the twelfth thoracic vertebra to the sacrum; the layer of fat and cellular tissue between the periosteum and dura was normal, except at the first, second, and third lumbar vertebræ, where it was replaced by what appeared to be a growth, at least, by a reddish, fleshy-looking mass (Fig. 6). The dura was congested, and the spinal fluid was turbid and bloody. Examining the bodies of the vertebræ laterally and in front, they were found to be decidedly diseased, especially on the left side and in front. Pus, with broken-down bone, could be seen and felt. Between the dura and the bone was a large fleshy mass. This occupied the position in front and on each side of the cord. The cord itself was intact, although probably considerably flattened. Permission was given to remove the cord and attached mass, but not the bone.

Microscopic examination of the extradural tumor showed it to be an endothelioma.

Case VI.—Probably tumor of the cauda equina. Mrs. E., aged fifty-two years, was seen by me in consultation with Dr. S. Stalberg in the beginning of 1906, from whom the following history was obtained: She was born in Russia. Family history negative. Occupation, ordinary housework duties. She has had eleven children, of whom nine are living, and has had no miscarriages. She has never been sick, except many years ago, when she had hemoptysis during pregnancy. No rheumatism or tuberculosis has

occurred in the patient or family. Present illness began about five months ago, with pain and tenderness over the right sciatic nerve at its point of exit from the innominate bone. This was followed in two months by the same condition in the left side, though on the right side the pain was always more severe. At the end of the third month of her illness she had quite profuse uterine bleeding lasting three or four days, her menopause having occurred two years previously. This bleeding was followed by another in two weeks. A vaginal examination was made by Dr. Dorland, who attributed bleeding to an eroded cervix, but he was unable to find either uterine cancer or any other pelvic condition causing the "sciatica."

FIG. 6.—Endothelioma on the outer part of the dura over the cauda equina. The tumor has been cut through.

Almost all of the antirheumatics and analgesics, nitroglycerin, potassium iodide, mechanical means, such as splint (for a few days) and compression, bloodless stretching, were tried, but without success. The pain became intense, extending to the muscles of the thigh and to the knee and back.

Notes dictated by me on February 6, 1906, are as follows: She is in great pain. Passive extension of the lower limbs causes much pain. The lower limbs are not greatly wasted. She can flex either leg at the knee to about the normal extent, but can flex either thigh at the hip only partially, and she prefers to lie with thighs partly flexed, in

order to avoid stretching the sciatic nerves. The patellar reflex is present, but diminished on each side; she has no movement of either leg on the thigh, and merely slight contraction in the quadriceps muscle, which is weaker on the left than on the right side. She cannot be tested for tactile sensation on account of the difficulty to make her understand. The Achilles reflex is present on each side, but diminished. The muscles of the calf and thigh seem to be somewhat tender to pressure, but it is impossible to tell to what extent. She seems to have voluntary movement of the feet. She complains of some pain in the lower part of her abdomen, but the abdomen does not seem to be at all tender to pressure. The muscles of the abdomen are so flaccid that it is impossible to determine any abdominal reflex. There seems to be no tenderness over the spinal column, and no deformity of the vertebræ. She has no disturbance of the bladder and rectum.

February 27, 1906. Extension of the right leg on the thigh, or left leg on the thigh, causes pain as soon as the leg is almost fully extended. The patellar reflex is much diminished and apparently lost on each side. Achilles-jerk on either side is much diminished. Muscles of calves are very flabby, but pressure of them does not seem to cause intense pain. She has great difficulty in flexing either thigh on the abdomen. She can move either leg on the thigh much better than she can move the thighs. She has no Babinski reflex. Pinprick is perceived in both legs. There is no disturbance of sensation around the buttocks or in either lower limb, objectively tested by a pin. She says the spinal column is tender to pressure in the lower part, but this tenderness cannot be tested positively. It cannot be determined whether there is any diminution of sensation or not. Any turning of patient in bed causes great pain, and the sciatic notch is very tender.

March 26, 1906. The lower limbs are weaker than they were when she came to the hospital, especially the right. Sensations of touch and pain are normal in the lower limbs. The patellar reflex is greatly diminished on each side, or even lost. The Achilles reflex is prompt on the left side, lost on the right. She still has perfect control of the bladder and bowels. Muscular atrophy is present in each leg, especially the right. Babinski's sign cannot be determined, because of resistance of patient. She has some tenderness to pressure in the lumbar region, but no deformity.

The patient left the hospital, and Dr. Stalberg informs me that she died about May, 1906, six weeks later. She was not under his care at that time, but her symptoms during these last weeks of her life were about the same as during the previous period.

Operation was not desired by the patient, and a necropsy was not permitted.

Case VII.—This patient, a woman about forty years of age, was seen November 1, 1906. She had had signs of pulmonary tubercu-

losis, and had had for some months pain in the right lower limb and in the lumbar region. About October 24 she had become rapidly paralyzed in both lower limbs.

The notes of her condition at my examination are as follows: The lower limbs are completely paralyzed, with the exception of slight movement at the hips. The muscles of the entire limbs are slightly sensitive to pressure. The patellar reflex and Achilles tendon reflex are completely lost on each side. Babinski's reflex is not obtained. Pressure over the muscles of the calf causes no movement of the big toe. There is no control of the bladder or bowel. Sensation of pin-prick and touch seems to be about normal over the front of each thigh; it is completely lost over the left buttock, to about four and one-half inches from the anus, and the line of demarcation seems to be sharp. It is lost to about the same extent over the right buttock, but the limitation of this side was not accurately determined, in order to avoid disturbing the patient. The sensation of touch and pain is lost in a narrow zone down the back of each thigh, to, or nearly to, the popliteal space. It seems to be lost or greatly impaired down the back of each thigh, and in the sole of each foot. In the rest of each leg below the knee sensation to touch and pain is greatly impaired, as compared with that of the upper limbs. There is no tenderness over the spine, sacral or coccygeal regions, nor has there been. The paraplegia of the lower limbs occurred within twelve hours, about October 23, 1906. She was probably getting weaker in the lower limbs some time before this. The subjective pain in the left lower limb has been present only about a week, and is about in the same distribution as in the right lower limb, namely, in the outer portion of each thigh. The pain in the right lower limb had been present several months.

A necropsy was not obtained in this case.

In addition to these seven cases, I have observed, as a chance finding at necropsy, in the service of Dr. Dejerine at the Salpêtrière, a lipoma of the filum terminale and a small osteoma of one of the roots of the cauda equina.

The following case is one in which a diagnosis has been very difficult:

Case VIII.—H. H. P., aged thirty years, was first seen by me in consultation with Dr. A. D. Whiting, February 12, 1903. He had done heavy manual work. He was struck on the outer side of the right knee about eight years ago. He had an extensive synovitis for three months only. In February, 1902, he began to have pain in the right knee. No cause was known for this, and he had not had any injury. He had been working very hard during a strike and over hours. He went out in all kinds of weather and had great exposure, with little rest. Pain came at first in attacks, and the first attack came after he had been out with the snow sweepers. He has never had pain anywhere else than in the right thigh. At first the

pain was in the right knee only, and later he thought it extended from the knee up the thigh. He has been treated only for knee trouble. He has pain in the right hip now also, and thinks he has it in the outer and inner sides of the right thigh. It is a steady aching pain, but at times sharp and cutting. When he has the pain all the muscles of the right thigh are sore to pressure, but no tenderness is felt except when he has pain. It is worse at night and when he is in bed. He has been to Hot Springs, Virginia. Atrophy seemed to increase when he was in bed. He had gonorrhœa ten years ago, but never syphilis. An *x*-ray photograph shows nothing in the knee or pelvis, but the acetabulum of the right side may be a little roughened. Dr. Willard says the patient has not bone or joint disease. No malignant history in family, but there is tuberculous history on the mother's side. Very recently he has had a sensation like a tired muscle pain on the outer side of the right leg below the knee. He had been riding horseback before he had pain below the knee. Two other children are in the family. A sister died of typhoid at the age of twenty-three years, in May, 1900. She was fairly well until she had typhoid. An older brother is living and has some bronchial trouble ("fibrinous bronchitis").

Present Condition. February 12, 1903. The patellar reflex is distinctly exaggerated on each side, but more so on the right, where it is much increased. Dr. Whiting says every reflex was normal six weeks ago. Patellar clonus is obtained on the right side, not on the left. Slight indication of ankle clonus on each side. No Babinski is found on either side, and the toes, including the big toes, are flexed. Achilles-jerk is very prompt on each side, and a little exaggerated. Middle of right thigh measures 15¼ inches; left thigh, 16 inches. Middle of right leg measures 12½ inches; left leg, 12¾ inches. The atrophy in the right thigh, inner and outer aspects, is very visible; atrophy of the right leg is also very distinct, but the atrophy of the right thigh is greater than that of the right leg.

Station and gait are nearly normal, even with the eyes closed. He has no Romberg sign and no bladder and no rectal symptoms. Tonicity of lower limbs is about normal. Sensations of touch, pain, and temperature are normal in the lower limbs and equal on the two sides. A slight tendency for the right foot to turn inward is observed. Cremasteric reflex is present on each side, but not very prompt on either side, and more distinct on the left side.

Upper limbs are not atrophied, but he has lost weight generally. Biceps tendon, triceps tendon, and wrist reflexes are very prompt on each side, but biceps tendon reflex is distinctly prompter on the right side. Voluntary power and sensation of touch, pain, and temperature are normal in the upper limbs. Resistance to passive movement is normal in the upper limbs. The hands are not wasted.

Blood examination gives normal findings: hemoglobin, about 87 per cent; over 4,000,000 red blood corpuscles.

Urine, normal; a faint trace of albumin was found only once.

The head is normal. The tongue is protruded straight, not atrophied. Jaw-jerk is not increased. Masseter muscles contract firmly. He has no involvement of muscles of the seventh nerve on either side. The pupils are equal, irides react normally to light, in accommodation and convergence. Movements of the eyeballs are normal. Vision is good.

It is not known how long the atrophy has been present in the right lower limb.

He has no pain on pressure over the spinal column, or on pressure of the head and shoulders downward.

I saw this patient again May 2, 1903. Pain is constant; it has never been better, and at times a little worse than when last seen. The character of the pain has changed; it is sharper, and when he is walking it seems to be confined to the knee. He has no pain in the left lower limb. When he is awakened at night the pain seems more in the hip, and at times in the back. He has no symptoms on the part of the bowels or bladder. His right foot gets cold at times. Pain is still along the front of the thigh, not along the back of the thigh, and not usually below the knee, except occasionally it extends a little below the knee on the front of the leg.

Resistance to passive movement is a little less in the right lower limb. Right thigh (a little below the middle) measures 15 inches; left, 15¼ inches. Right leg measures 13 inches; left, 13 inches. The right lower limb does not appear so much atrophied as it did previously. The right patellar reflex is normal. There is no patellar clonus on either side. Achilles reflex on each side in Babinski position is about normal; if anything, the right is a trifle weaker than the left. Sensations of touch, pain, and temperature in lower limbs are normal, even in front of the right thigh. Gait is normal, except when he has pain. He had some pain just above the pelvis in back during past three weeks; since, he has had passive movement of limb. The pain seems to be confined to the distribution of the right external cutaneous nerve.

The eyes were examined by Dr. Shoemaker. His report is as follows: "The results of my investigations into the ocular condition of the patient are negative. His vision, accommodation, fundus, pupils, ocular movements, muscle balance, and visual fields are normal."

I saw him again November 14, 1903. He had been in California for five months riding horseback and exercising in the open air, and had had Swedish movements, hot sulphur and hot mud baths. The pain has continued as severe as ever, and is in the same place. Sometimes he has pain above the crest of the ilium, and it may extend as high as the lumbar region. He thinks the pain is a little more severe at times. He has never had pain in the back of the thigh nor on the inner side of the thigh. On rare occasions it may extend on the

outer side of the right leg half way below the knee. Never has he had any pain in the left lower limb, and never had disturbance of bowels or bladder. He has been *x*-rayed repeatedly, and nothing abnormal has been found. Pain is worse about 2 inches above the patella on the outer side of the thigh. Middle of right thigh measures 16½ inches; of the left thigh, 17 inches. Middle of right leg measures 12½ inches; of left leg, 12½ inches. The right thigh is distinctly atrophied, especially in its inner portion. He weighs now 130. Normal weight is 150. The whole right lower limb is distinctly wasted, but more in the thigh. The gluteal muscles on the right side are also wasted.

The patellar reflexes are prompt, probably more so than normal, but not excessively so. Patellar clonus is not present on either side, and he has no ankle clonus on either side. Achilles-jerk is about normal on each side. Sensations for touch and pain are normal in all parts of the lower limbs. He walks now with a little limp in the right lower limb. No points of tenderness are found in the lower limb. The patellar reflex on the right side may not be quite so prompt as at the former examination.

He was seen by me again April 30, 1904. Since he was last seen Dr. Whiting cut the external cutaneous nerve, December, 1903; he did not suture it or bring the ends together. In February, 1904, Dr. Whiting made an exploratory operation in the lower part of the right thigh, and nothing abnormal was found. General condition has been good, with, at times, mental depression. Pain is unaltered. It still centres about the knee, but extends now more below the knee than into the thigh. He limps, but limping seems to depend upon the pain and varies with the intensity of the pain. The electrical reactions are normal in quality, but diminished quantitatively. The right lower limb, both thigh and leg, is distinctly wasted, and the wasting of the leg is greater than it was at my last examination. The patellar reflex on the right side at times is weak, the leg is thrown forcibly out, but the movement is sluggish. The patellar reflex on the left side is about normal. The Achilles-jerk on the right side, Babinski position, is not quite so prompt as on the left side. The pain is usually on the outer side of the leg, below the knee, seldom on the inner side of the leg, and is of the same character—"sharp, like a toothache or headache—a steady grind, never darts down the limb." Resistance to passive movement is not so good in the right lower limb (flexion and extension of leg or foot) as in the left lower limb. He is analgesic and anesthetic in the outer part of the thigh in the distribution of the external cutaneous nerve, but he has no paresthesia in this area. He has no Babinski sign on either side. Gait is not ataxic, even with the eyes closed. No vesical or rectal disturbance.

At the present time, February, 1907, his condition is about the same as at my last examination. He has been seen by Drs. Osler,

Erb, Gowers and other neurologists in this country and in Europe. A small non-malignant tumor, such as the small osteoma I have described above, implicating a few nerve roots, might explain the symptoms in this puzzling case.

I am indebted to Dr. Alfred Reginald Allen for most of the photographs.

MORBID SOMNOLENCE.

By D'Orsay Hecht, M.D.,

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Our present state of knowledge, or lack of it, concerning morbid somnolence, justifies, I believe, this somewhat more than cursory comment of a case seen for the first time during October, 1906:

W. L. J., male, colored, aged forty-eight years, a native of Kentucky, twice married, and a sleeping-car porter by occupation, was kindly referred to the neurological clinic of the Northwestern University by Dr. Gottfried Koehler, whose privilege it had been to observe the patient for a brief period in the medical department.

The essential complaint appearing in the first-taken medical history was that of inability to keep awake. The patient had for a long time prior to his visits to the clinic received various treatments, all aimed at overcoming attacks of sleepiness. From medical premises, a group of symptoms were revealed consisting of very moderate dyspnœa, occasional, severe, but short-lived pains about the heart, insignificant swelling about the feet and ankles, frequent micturition at night, slight periodic headaches, a large appetite, and an inordinate thirst for water. Dr. Koehler reported several analyses of single and twenty-four hour specimens of urine, which showed an average of 0.4 per cent. albumin in 3000 c.c. voided, and the presence of granular, epithelial, and fatty casts in the centrifuged sediment; sugar was absent. The heart was found to be somewhat displaced downward and to the left, the apex beat extending to the nipple line; the second pulmonic sound was not very clear; the second aortic sound was slightly accentuated, but murmurs were not heard. Œdematous swellings at the ankles or along the extremities were not noted, although the patient referred to their occasional presence. These evident signs of renal and cardiac embarrassment, together with the aforementioned subjective symptoms, were taken to indicate the presence of a secondary contracted kidney.

The patient is rather obese, having weighed between two hundred

and two hundred and sixty pounds for the past twenty-five years, but is doubtful whether this surplus weight is in any way a factor in initiating the sleep seizures. Oft-recurring and excessive drowsiness rather readily lends itself to a presumption of organic brain disease, chiefly of a luetic nature and to admit or dispose of its likelihood in this case, a careful examination of the nervous system was undertaken. There were several physical findings of interest from a neurological viewpoint, but special stress is given the sleep phenomena.

There is a white strain in the paternal antecedents, proudly admitted by the patient and evidenced by his yellowish-black complexion. His childhood was free from attacks of acute infectious disease, and he recalls nothing eventful during adolescence, except two severe spells of "chills and fever" which yielded promptly to quinine. Specific disease acquired at eighteen, and but very indifferently treated, caused an illness of more than a year's duration characterized by sore throats, bone-pains, and vesperal headaches. This experience, however, together with that of a gonorrheal infection occurring shortly thereafter, did not deter him from marrying at the age of twenty-two. It is worthy of emphasis that his wife had neither children nor miscarriages and at thirty-eight years of age experienced a paralytic stroke, which terminated fatally within twenty-four hours after the onset. A second marriage likewise has been completely barren. At the age of forty the patient contracted a severe attack of la grippe, from which he thinks he never fully recovered, and he is disposed to regard this illness as the direct forerunner of his present complaint. It may be relevant to add, that the patient smokes and drinks very moderately, partakes of little coffee or tea, has cultivated no drug habits, and says he is sexually temperate.

The sleeping spells have appeared with gradually increasing frequency and duration since 1895. At first he thought lightly of his "naps" attributing them to the long-waking hours incidental to porter service and railroading, until one day he fell asleep in the midst of making up a bed and on another occasion "suddenly dropped off" in the course of a conversation. "Sleepy Bill," as his associates were prone to call him, finally had so much difficulty in keeping awake that he left "the road" in 1902. Ever since that time he has sought various kinds of employment, but once caught sleeping, is unable to retain his position. Keeping constantly on the move or doing real, active, manual labor is his only hope of keeping awake.

He experiences an unconquerable desire to doze about every three hours, much depending upon the quiet and solitude of his surroundings. If not disturbed, sleep lasts from one-half to one hour; is perfectly refreshing and so light withal, that nothing said within hearing distance escapes him. In this connection he relates an unpleasant incident of having fallen asleep in a crowded lunch-room, when he overheard the unkind remark "see how he sleeps; I'll bet he hasn't

an ounce of brains;" he snored and slept on, but on awaking showed his resentment by knocking down the offender.

In attendance at church he falls asleep, but hears every word of the sermon and only realizes that he was asleep when told so by others. The onset of the slumber is sudden, coming on without warning and unaccompanied by peculiar sensations other than mere drowsiness, giving way quickly to deep sleep. The ease with which he is aroused is significant, a soft word or light touch being sufficient. He is immediately himself, free from even the slightest bewilderment, without dizziness, without headache, without mental hebetude or depression. In the interval between naps there is no drowsiness. Dreams, chiefly of the terrorizing kind, not infrequently disturb his slumbers. The longest single period of day-sleeping has been one hour. The patient can tell the difference between these and the natural night sleeps or the normal tired states preceding them. Recently, while demonstrating his case, he had an attack and when last opthalmoscoped he was overpowered. Several times he has slipped from a high stool while writing and sank to the floor in sound sleep.

After a normal night's rest he is refreshed, but nevertheless gets up with great reluctance and says he could easily sleep all day with short intervals for food and drink. His fear of detection has been great, but his determination evidently insufficient to overcome the irresistible impulse.

An examination of the nervous system points to some organic impairment, although the anomalies noted do not satisfactorily account for the sleep seizures.

The pupils are of normal size, react properly to light and accommodation; no ocular palsies. Dr. Mortimer Frank, to whom I am indebted for a painstaking examination of the fundi, reports them negative; visual acuity of $\frac{6}{5}$ in right eye, and $\frac{6}{6}$ in left eye, with Jaeger test type No. 2.

The conjunctival reflex is brisk; the faucial reflex present, but not marked; jaw jerk normal; wrist taps present and bilaterally equal; right patellar normal and with reinforcement very brisk; left patellar absent except with reinforcement; right cremaster brisk; left cremaster very sluggish; left Achilles jerk obtainable (positive) without reinforcement; right Achilles present only with reinforcement; both plantars present on rather sharp stimulation; Babinski toe sign absent.

Coördination is everywhere good, there being not the slightest evidence of ataxia of gait or station; and no ataxia in the upper extremities. No sensory disturbances of any kind, subjective or objective, are noted at the present time.

The abdominal viscera are apparently normal. An analysis of the stomach contents was not made. Of the thoracic organs the heart has received mention and the lungs were found to be normal. There was no marked adenopathy.

The medical diagnosis submitted, based on signs and symptoms

of moderate severity, was one of secondary contracted kidney. It is not unlikely, I think, that the anomalous state of the tendon reflexes, namely, their contralateral disparity, results from a past spinal lues, although in the absence of more definite motor or sensory disturbance, this is taking perhaps much for granted. It would surely be less rational to think of such variability in tendon reflexes as hysterical, and to suspect a cerebral lesion seems altogether far-fetched. Perhaps it were as well to suspend diagnosis and say, that whatever the pathology in question, it is quite unrelated to the sleep attacks at issue. This brings us to a consideration of the causes of morbid sleep states, which subject is impossible of comprehensive treatment without references to previous views and writings.

Narcolepsy is the term now universally accepted to designate a state of pathological somnolence. By it we mean an irresistible, uncontrollable inclination to sleep, which overtakes the individual suddenly, lasts for a variable period, and recurs at frequent though irregular intervals. Gelineau[1] in 1880, gave us the first definition and description of narcolepsy as a disease sui generis.

In a rather meagre literature, handed down to us before and since the time of Gelineau's characterization of a "sleep neurosis," the citations under the name of narcolepsy set forth the most weird and perverse forms of somnolence without the least regard for etiological factors or the presence of associated disease. In 1884, C. L. Dana[2] reported 7 cases which he held to be "in the main expressions of some neuropathic state" and then offered a clinical classification which was intended to differentiate sharply essential from secondary forms of morbid somnolence. Sympathetic somnolence might arise from senile and cardiovascular changes; might be due to exhaustion, obesity, organic cerebral disease, and diabetes, or be derived from the toxemias of malarial, uremic, cholemic, and syphilitic disease. The essential forms may be classified as follows: (1) Epileptoid sleeping states. (2) Hysteroid sleeping states including (*a*) spontaneous "mesmeric" sleep, (*b*) trance and lethargic states. (3) Morbid somnolence, the expression of a distinct neurosis (narcolepsy). Dana's analysis of his cases went far to show the existence of a narcoleptic state per se, since a most painstaking inquiry into the physical condition of the individual patients failed to reveal a cause for the somnolence.

McCarthy[3] believes with Ribakoff that "sleep attacks" constitute one of the phenomena of degeneracy; that these cases occur in degenerate individuals; and that the recurring attacks of sleep are not the disease, but merely a syndrome occupying a prominent position among other phenomena of degeneration."

To add to the growing perplexities of the problem, Furet[4] and

[1] De la Narcolepsie, Gazette des Hôpitaux, 1880, p. 626.
[2] Jour. Nerv. and Mental Dis., 1884, xi, 153.
[3] Amer. Jour. Med. Sci., February 1900, p. 178.
[4] De la Narcolepsie, Thèse de la Faculte de Paris, No. 303, Roussl.

Sainton[5] affirm an autotoxic pathogenesis. Furet states that diabetes, influenza, and even epilepsy arise from endogenic intoxicants—that narcolepsy may be an associated symptom in any of these disorders —ergo an autotoxic pathogenesis is the near explanation. Stern[6] attracted to Furet's views has occupied himself with most elaborate analyses of the blood and urine, of stomach contents, and animal experiments in a case of narcolepsy, and concludes that autointoxication played no part whatever in the sleep seizures of his patient.

Ballet thought the term narcolepsy should include all degrees of somnolence from the mildest drowsiness to the deepest sleep and he so applied it, even to calling "the nap" after a heavy meal, narcoleptic.

Lowenfeld[7] is the last writer to survey critically the narcolepsy question, if such it may be called, and favors the retention of the word "narkolepsie" to designate a distinct neurosis. He does this only after a searching analysis of Gelineau's text in which motor inhibiting phenomena (motorische Hemmungsvorgänge) receive consideration quite as fully as the sleep attacks. He maintains that the morbid process in the brain giving rise to the one is equally responsible for the other and in the absence of demonstrable structural changes the syndrome must be classed with the neuroses. If any reticence has been shown in accepting Gelineau's narcolepsy as a distinct disease, I believe it is owing to the author's failure to force upon the attention of subsequent readers and observers the very points more clearly enunciated by Lowenfeld. An opportunity was seized to combine loosely all pathological sleep states and sleep-like states (Schlaf-zustande and schlafartige Zustande) and qualify them as hysterical, epileptic, or diabetic under the broad caption of narcolepsy.

Here, as elsewhere in medicine, we are witnesses to a quibbling over what shall constitute a morbus sui generis or clinical entity as we are pleased to translate it.

A brief sleep attack is frequently a conspicuous feature in the petit or grand mal type of epilepsy. A patient so afflicted is not easily aroused and experiences some mental torpor for a time after awakening, which in turn may be followed by a variable period of gloom and depression.

The narcoleptic habit is not an uncommon incident in the course of diabetes. Sleep attacks then of abnormal type are associated with these diseases, and it should be added that the stuporous state of cerebral syphilis requires differentiation. In this case the evidence of past syphilis, the presence in a mild degree of renal disease, and the element of obesity, seem separately or in combination to offer an explanation for sleep attacks, and yet the narcoleptic habit is here sufficiently pronounced and distinctive to merit, in my opinion, its presentment under the caption of morbid somnolence.

[5] Gaz. hebdomadaire de méd. et chir., No. 34.
[6] Med. Record, 1902, p. 47.
[7] Münch. med. Woch., 1902, p. 1041.

A FATAL CASE OF PONTILE HEMORRHAGE WITH AUTOPSY.

By Theodore Diller, M.D.,

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References to pontile hemorrhage are comparatively rare in the literature. But sixty-seven papers on the subject are noted in the Index Catalogue of the Surgeon General's Library, published in 1890, and of these but very few are of American origin. I have not attempted to gather all cases published since 1890; but reference to some of the more important of them is appended to this report. The text-books have but little to say on the subject, and many of them omit all mention of it. Among the few text-book writers who speak of pontile hemorrhage is Guillian,[1] who mentions, among its symptoms, the following: vomiting, irregular respirations, polyuria, single or double hemiplegia, paralysis of the lower face and of the tongue and larynx. Erb names elevation of temperature as a significant sign.

Deshusses[2] reports the case of a nineteen-year-old man, who, following an attack of unconsciousness, showed loss of sensation, contracture, conjugate deviation of the eyes, myosis, and increased respiration. The autopsy showed a diffuse meningeal hemorrhage over the bulb. Glasser[3] reports 19 cases of pontile hemorrhage. In only one case were convulsions noted. Kidney disease and alcoholism often stood in casual relationship. Leszynski[4] reports the case of a woman, aged fifty-five years, who had become suddenly ill with dizziness and vomiting. When he saw her, thirty minutes after the onset of her trouble, she was conscious. Her lower face on the right side was paralyzed and she exhibited a left hemiplegia and left ptosis. Both pupils were equal and contracted to 1 mm., and immobile. A few hours later coma developed, and the patient died twenty-three hours after the onset, having developed a temperature of 105° just before death. No autopsy was held. By far the most important recent paper on the subject of pontile hemorrhage and softening is that of C. L. Dana.[5] Dana believes, as the result of his own experience, that softening of the pons occurs more frequently than does hemorrhage. He himself, in his extremely valuable paper, reports 2 cases of hemorrhage and 9 of softening. He has collected 46 cases of hemorrhage with autopsies. Adding these to those collected by Bode and Larcher, Dana studied 190 cases. He concludes, from this study, that the more frequent causes

[1] Traité de médecine par Bouchard et Brissaud, p. 512.
[2] Gaz. hebd. de médecine, p. 695.
[3] Allg. Med. Central. Ztg., p. 1186.
[4] New York Med. Jour., 1897, lxv, 767.
[5] Medical Record, 1903, lxiv, 361.

of pontile hemorrhage are nephritis and arteriosclerosis. The arteries most frequently involved are the transverse and medium branches of the basilar.

Dana describes the symptomatology of pontile hemorrhage in these words:

"The patient has some prodromal headaches and malaise for a few days, with vertigo and sometimes vomiting. Then he falls suddenly, as if by a lightning stroke, into a coma, usually very profound. There are twitchings of the face or of the limbs, or both, but rarely any general convulsion (3 cases). The face is flushed, there is a fall of temperature, and the pulse is irregular, but not markedly increased or slowed; as a rule, the respiration is slow, 4 or 6 per minute, or more often irregular and of Cheyne-Stokes type. The pupils are contracted to a pin-point, and do not respond to light, but may be uneven. There is convergent strabismus or conjugate deviation of the eyes. The limbs are at first stiff, but may be relaxed later and the reflexes increased.

"The patient cannot be aroused, but can be made to vomit. A few hours later the temperature rises, sometimes very high—106° to 108°—but usually not. There are involuntary movements of the bowels, swallowing is impossible; evidences of dyspnœa are shown. The pulse becomes more rapid, cyanosis develops, and the patient dies in from six to twenty hours, usually with evidence of paralysis of respiration.

"If the hemorrhage is less severe, the coma is less profound or may be absent, the patient shows signs of agonizing suffering and difficulty in respiration, evidences of crossed paralysis, crossed anesthesia, and disturbance of equilibrium and ataxia can be noted."

Oddly enough, he makes no mention of double hemiplegia in this description. But in consideration of the structure of the pons, it will be readily seen that there may be either single or double hemiplegia, or crossed paralysis; or paralysis of the fifth, sixth, or seventh nerves may occur, depending upon the location and size of the hemorrhage.

Many of the symptoms of softening are the same as those resulting from hemorrhage, differing chiefly in the mode of onset, being slower and more irregular in development.

I may quote at this point one of my own cases of pontile softening which I published several years ago, and which raised a point that was suggested to me by Dr. Dana's first paper, viz., the differential diagnosis between pontile softening and opium poisoning, there being several striking features common to both—stupor, contracted pupils, irregular and slow respiration. There is much that is common in the symptomatology of pontile softening and pontile hemorrhage. To illustrate, I may refer to a case of pontile softening I reported several years ago: A woman, aged sixty-six years, slowly developed coma with twitching of the face and a temperature of 103°. She

exhibited an external squint and immobile, pin-head pupils. The case was very similar to the one I report herewith; but because of the slowness of development, I made a diagnosis of softening rather than of hemorrhage of the pons.

The case is that of a woman aged sixty-three years. She was admitted to the Allegheny City Home, in 1871, on account of delirium tremens. She remained there several months. She was then twenty-nine years of age, and described as having been born in Germany, married and deserted. She had with her then a baby five months old and a daughter six years old. The latter was afterward admitted into the insane department.

For several years after her admission the patient was violent and troublesome in many ways, but for the past fifteen or twenty years she has been a model patient. Her condition was one of secondary dementia. She worked regularly, and for many years her physical health appeared good. She, therefore, has been an inmate of the Home continuously for thirty-four years.

On May 20 she had an attack of vomiting and purging, with some clouding of consciousness, but no paralysis. Her pulse was full, strong, and compressible, and about normal in rate. As the patient was an inordinate eater, the condition was believed to be due to acute indigestion; and she was ordered divided doses of calomel. But her condition grew rapidly worse, and on the morning of the next day she was unconscious. Her respirations were hurried and of a somewhat stertorous character.

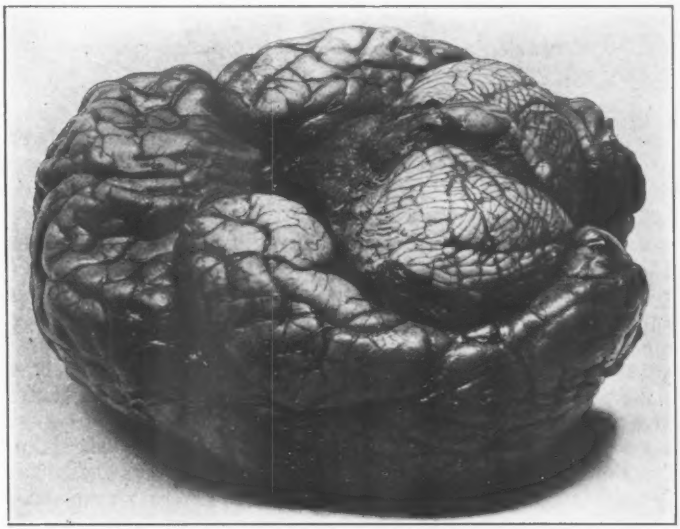
In the afternoon of this day (21st), the patient was examined by Dr. Henninger and myself, who were visiting the institution with Dr. Allen, the resident physician. The case was now evidently one of apoplexy. In raising the arm and letting it fall, to determine which side was hemiplegic, there appeared very little difference on the two sides. Both arms fell in a limp fashion on several tests. It appeared, therefore, that there was double hemiplegia. The pupils were very small—about 1 mm.—equal, and immobile. The patient was profoundly unconscious and her respirations stertorous, about 20 to the minute. The axillary temperature was 99° F.

The diagnosis of pontile hemorrhage was ventured on the basis of these points: double hemiplegia, myosis, and the suddenness of onset with vomiting. She died about thirty hours after we saw her and without developing any new features.

About twenty hours after death an autopsy was performed by Drs. E. W. Willets, Geo. Wright, and Chas. W. Allen. The vessels at the base of the brain were discovered to be in a state of advanced degeneracy, being hard, tortuous, and calcified in many places. Over the entire area of the pons, beneath the pia mater and extending down over the oblongata for three-quarters of an inch, was a large, thick hemorrhage, firmly coagulated (see figure). The exits of all

the cranial nerves from the third to the eleventh were involved in the clot.

The brain was removed and placed in a 5 per cent. solution of formaldehyde after the ventricles had been opened. A month later a section of the brain was made. The clot over the pons was shown to be about one-eighth of an inch thick. There was some hemorrhage under the pia and between the cerebellum and the cerebrum,



Photograph of a brain showing hemorrhage over the entire pons and the upper medulla oblongata.

which had probably come from the pontile hemorrhage. There was no hemorrhage in the interior of the pons. The exact source of the hemorrhage could not be ascertained, but it must have come from one of the vessels of the circle of Willis, or else—and most probably—from the basilar artery.

Unfortunately, the specimen does not lend itself well to photography, and the hemorrhage is not so well shown in the accompanying photograph as I could wish.

CHORIO-EPITHELIOMA OF THE UTERUS.

REPORT OF A FATAL CASE, WITH OPERATION AND AUTOPSY.

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As the name implies, chorio-epithelioma is a growth which develops from the epithelium of the chorion. In its normal role this epithelium helps to form the blood sinuses of the placenta by eating through the walls of the capillary vessels in the decidua. During the development of the placenta, the chorionic cells, as a rule, penetrate the entire thickness of the decidua, and some of them may be found in the uterine muscle.

In chorio-epithelioma, the chorionic cells either have an increased power of penetration or there is a diminished resistance to the penetration, so that they invade the maternal tissues to a much greater extent than normally, producing widespread destruction at the placental site. Metastases, which exhibit all the characteristics of the parent growth, may occur to any of the visceral organs. It is a surprising fact, but one that is easily explained by the nature of the growth, that chorio-epithelioma is not always malignant. The ultimate result alone in a given case will determine the malignancy, even though it is impossible completely to extirpate the growth. In other words, given a case of chorio-epithelioma which has extended beyond the limits of a radical operation, the excision of the major part of it and the adoption of measures to increase the resisting power of the individual may result in the absorption of the extensions and the metastases. Pick has recorded a case illustrating this point, in which there was every indication of metastasis to the lung, and yet the patient completely recovered after removal of the primary lesion. The mortality in 124 cases recorded by Ladinsky was 50 per cent.

While chorio-epithelioma usually begins in the uterus at the point where the placenta is attached to the uterine wall, it may originate in chorionic tissue which has been transplanted by way of the blood channels to more or less remote parts. Primary chorio-epithelioma of the vagina has been reported. Chorio-epithelioma is sometimes apparently of embryonal origin—as, for example, in the case reported by Lubarsch in a girl aged twelve years, who had never menstruated, and in a testicular tumor by Schlagenhaufer, and in an ovarian cyst by Pick. In such cases some of the very early

blastomeres which contain the elements producing the fetal envelop became displaced and subsequently developed.

The origination of a chorio-epithelioma which is not embryonal is probably in some way connected with the pathological physiology of placentation. Forty per cent. of chorio-epitheliomas are preceded by hydatidiform mole.

Recently it has been said that disease of the lutein tissue of the ovary may cause chorio-epithelioma and hydatidiform mole. This would bear out the hypothesis of Born and the experimental conclusion of Fraenkel, that the corpus luteum is the secreting part of the ovary and is intimately connected with the embedment and the nourishment of the fertilized ovum.

The facts about the present case which were of importance are as follows: (1) The history, which did not very clearly suggest the disease. (2) The delay in performing a second operation; this was unavoidable, but it probably led to the fatal result. (3) The widespread metastasis of the tumor without involvement of the spleen. (4) The absence of chorionic villi in the growth or in its metastases; which bears on its malignancy, for villi are said to be absent in the most malignant cases. (5) The cystic condition of the ovaries, in which, however, the lutein tissue was not involved. The case is as follows:

Gyn. No. 1433.—Admitted February 11, 1905. M. H., aged thirty-one years; married fourteen years; seven children.

Labors.—Normal, instruments not required; no lacerations; youngest child two years old.

Menstrual Flow.—First appearance at the age of twelve; always regular until one year ago; duration five days; never painful unless she caught cold; moderate in amount.

Last Period.—Indefinite.

Leukorrhœa.—Past three weeks, white discharge streaked with blood. Past week, dark red, foul odor.

Family History.—Father dead, cause unknown. Mother living, fairly good health.

General Previous History.—Diseases of childhood; otherwise negative.

Present Condition.—In August, 1903, she bore a child. Following the confinement the menstrual periods remained absent until November, 1904. During the first five months of this time she had been nursing her baby. November 25, 1904, she began to pass blood from the vagina. For a week this hemorrhage appeared to be a menstrual flow such as she had been accustomed to have; at the end of that time, however, the amount of blood lost was excessive, and she had severe pain in the lower abdomen, with increased hemorrhage whenever she moved about. On one occasion, feeling a strong desire to empty the bladder and attempting to do so, she passed about a quart of blood clots. For a week she went on

bleeding and passing clots. She had bearing-down, labor-like pains in the lower abdomen. After this time the hemorrhage partially, but never fully, subsided. Walking or exertion would bring on a flow of blood. In December, after unusual exertion, she had chills and fever, and was obliged to go to bed for a period of three weeks. Subsequent to this attack she continued to have metrorrhagia upon the slightest provocation. Five days before admission the patient began to have a very foul vaginal discharge. The same day she suffered from a hemorrhage so severe that she was obliged to go to bed.

On Admission.—Temperature, 100.2°; pulse, 108; respirations, 28. Patient complains of "labor-like," bearing-down pains, associated with hemorrhage and foul, dirty red vaginal discharge.

General Examination.—Patient appears somewhat emaciated; skin and mucous membrane anemic. Examination of the chest is negative except for a blowing systolic heart murmur, which is evidently of hemic origin. Hemaglobin, 50 per cent. Urine normal.

Gynecologic Examination. Outlet parous; slight relaxation of perineum; cervix parous, soft; uterus size of three months pregnancy. Adnexa negative.

Operation February 13, 1905. Digital exploration of the endometrial cavity found it filled with a necrotic mass having a pedicle several fingers breadth in thickness attached to the left uterine cornu. Most of this tissue was removed piecemeal by means of the fingers and placental forceps. A portion of the pedicle remained attached to the uterine wall; this resisted slight efforts to detach it, and, as the uterine tissue was very soft, no further evacuation was made. The uterus was packed with gauze.

Histological Examination. The specimen shows irregular pieces of fibromuscular tissue, surrounded by pus and blood. Throughout the fibromuscular tissue are cells which occur either singly or in groups, some of them being small, about the size of the ordinary lymphoid cell; others are as much as ten times that size. The cells almost invariably show a distinct cell outline, and the protoplasm of the cell is large in proportion to the nucleus. This is true especially of the larger cells, many of them containing more than one nucleus and often as many as eight or nine. There are also masses very deeply stained, which appear like elongated nuclei, or like several nuclei bunched together, surrounding which either no cell body can be found or the cell body is extremely irregular. The muscular tissue is rich in blood channels, and the cells in question seem to show an especial tendency to penetrate into these channels, and in many cases they have done so. No chorionic villi are found. In some areas there are solid collections of cells which have all the appearance of Langhan's cells. These, with the irregular masses of protoplasm above described, justify the diagnosis of chorio-epithelioma.

After considerable persuasion the patient consented to a second operation. This was done on March 1, 1905. Panhysterectomy (Dr. Clark). The uterus was considerably enlarged. There was a purplish red nodule, the size of a pea, in the left broad ligament. There were no operative complications.

The *pathological report* of the specimen is as follows: Specimen consists of the uterus and adnexa removed by panhysterectomy (Fig. 1). The surface of the specimen is everywhere smooth and free of adhesions. The uterus is enlarged, measuring 13 cm. from portio to fundus. The fundus has a width of 8 cm.; the organ has been opened through the anterior wall. The uterine cavity measures 11 cm. in depth. The cervix is entirely normal. The endometrium for 2 cm. above the internal os appears somewhat thickened and œdematous in appearance. Above

FIG. 1.—Chorio-epithelioma of the uterus. At the fundus on the left side the tumor (purplish red on section, very dark in the illustration) has penetrated to within 8 mm. of the serous coat of the uterus. Both ovaries are riddled with Graafian-follicle cysts.

this point the endometrial cavity is occupied by a new growth, which has a smooth, regularly lobulated surface, yellowish gray in color, mottled with purplish red spots. Upon cutting through the mass at the fundus the surface of the section is purplish red, irregularly divided by interlacing bands of gray or reddish yellow; the purplish-red areas extend to and invade the inner layer of the myometrium. The grayish or yellowish-red bands, referred to above as interlacing irregularly throughout the purplish-red new growth, are apparently derived in part from the muscle of the uterine wall. At one point in the fundus the purplish-red growth has penetrated to within 8 mm. of the peritoneal surface. The greatest diameter of the wall of the uterine body is 2.5 cm.; this is at a point 4 cm. above the internal os. At the fundus the newgrowth almost everywhere extends to within 1.5 cm. of the peritoneal

surface. The right tube is 13 cm. in length and is entirely normal. The right ovary is enlarged (6 x 4.5 x 3 cm.). On section it is filled with cysts, which have a smooth lining and vary in diameter from 2 mm. to 2.5 cm. Some of these smaller cysts have a cherry-red color, and on section this color appears to be due to a hemorrhagic infiltration of the cyst lining. There is no luteum tissue which can be identified. The left tube and ovary closely resemble the adnexa of the right side. On the posterior surface of the right broad ligament, above the utero-ovarian ligament, 21 cm. to the right of the utero-ovarian anastomosis, is a nodule 8 mm. in diameter. It is hard and has a dark purplish-red color. It is not connected with any of the larger bloodvessels, so far as can be determined and, apparently lies free in the layers of the broad ligament.

Sections from the Fundus of the Uterus, Including the Newgrowth. The wall of the uterus is everywhere œdematous; toward the uterine cavity and some distance from the serous coat there is an infiltration, between the muscular bundles, of cells which occur singly and in groups. These cells vary in shape, size, and staining properties. Some of them are small, about the size of an ordinary lymphoid cell or slightly larger, while others are fully ten times this size. All of them can be distinctly outlined, and the amount of protoplasm in comparison to the size of the nucleus varies. Some of the larger cells have a relatively large amount of protoplasm, so that they appear more or less like squamous epithelium. Many of these large cells have more than one nucleus. There are also irregular masses of protoplasm, with elongated, irregular, and darkly stained nuclei seen throughout the tissue. The newgrowth seems to have special predilection for the bloodvessels. In some areas the cells are seen within the bloodvessels, while in others they form a part of the bloodvessel wall. They penetrate the myometrium in all directions; they occur in strings and bunches, and in no instance do they form gland-like spaces. There is little intercellular substance. Some of the cells closely resemble Langhan's cells. The muscular wall shows a dense inflammatory reaction. There are many broad areas of hemorrhage; this is especially marked and forms a very prominent feature of the histologic picture.

Sections from the Ovaries. The cysts referred to in the gross description, which had a cherry red color, proved to be Graafian follicle cysts, having extensive hemorrhages into the stroma beneath the granulosa cells. The ovary in general is somewhat œdematous. There is no evidence of any metastasis.

Sections from the Small Nodule in the Broad Ligament. This apparently is a vein to which metastasis has occurred. The vein is filled with blood which has begun to organize. The wall of the vein has been almost entirely destroyed by infiltrating cells which resemble the smaller ones found in the uterine newgrowth.

Until the fifth or sixth post-operative day convalescence was normal. At that time a persistent elevation of the temperature and of the pulse and respiratory rate led to an examination of the abdominal incision. This was in good condition. Several days later the patient complained of a slight cough and pain at the base of the right lung. Examination of the lung was negative. On the tenth post-operative day, because of the continuance of the above symptoms, a pelvic examination was made. An indurated area was found in the stump of the left broad ligament, which closely followed the pelvic wall to the brim of the pelvis. The patient's condition became progressively worse. On the eighteenth day there were subcrepitant rales at the bases of both lungs; on the twenty-second day the sputum became rusty. At this time a very loud, blowing,

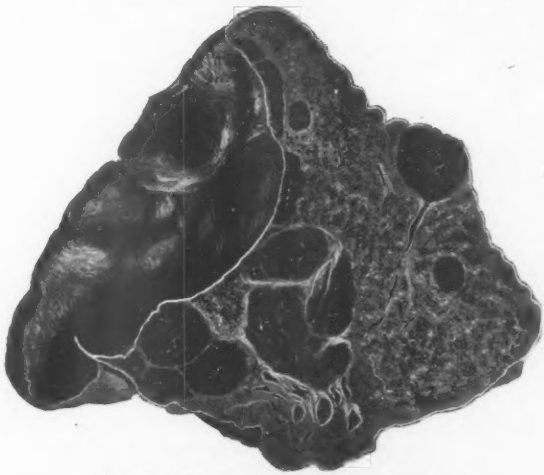


FIG. 2.—Metastases in the lung and pleura.

systolic murmur was present over the entire precardium. On the twenty-fifth day, with a temperature of 102°, a pulse of 150, and respirations of 36, she was removed to her home at her own request.

The patient died on the evening of April 5, about six weeks after the operation. An autopsy was performed on April 7.

Without going into minute details, some of the findings will be found of interest in connection with the clinical data already given. The body presented the emaciated and relaxed condition commonly seen in those dying from malignant growths, and the only specific evidence of the disease showing externally was a small, subcutaneous nodule in the left pectoral muscle about 2 cm. in diameter.

Internally, however, the metastases were very widespread, well-developed nodes being found in the following situations: Pelvic peri-

toneum, pelvic, lumbar, bronchial, and postperitoneal lymph nodes, right and left lungs, pleura, kidneys, liver, pancreas, and pectoral muscle (Figs. 2, 3, 4, and 5). (Permission was withheld for opening the cranium and spinal canal.) These nodules all presented very similar appearances; when small and newly formed they were rather sharply outlined, yellowish, and moderately firm, of about the consistency

FIG. 3.—Metastases in the kidney.

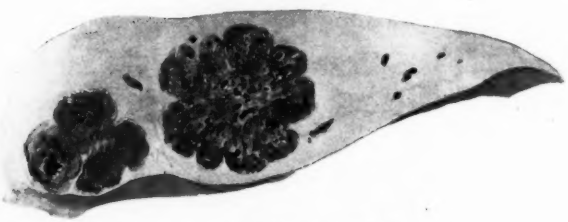


FIG. 4.—Metastases in the liver.

of normal splenic tissue, but when larger they were almost without exception round or slightly irregular, firm, meaty nodules, showing macroscopically a somewhat loose structure of fibrous tissue containing in its meshes a pulpy, dark red, friable material. These nodules were especially numerous and well developed in the lungs, which were extensively involved and partially collapsed by large

pleural effusions, especially on the left side, where a liter and a half of bloody turbid fluid was found. This lung and pleural involvement was evidently the immediate cause of death.

The tracing of the course of metastasis in this case was interesting. From the original growth the secondary lesions could be found next involving the pelvic peritoneum and lymph nodes, from which the chains of lymphatics could be directly traced to the liver by enlarged and involved nodes. In the liver the tumor cells, by their inherited function of eroding bloodvessels, had evidently entered the cava inferior; thence through the right heart they reached the lungs, and thence through the general circulation the other organs involved.

The microscopic study of sections prepared from this tumor was also of interest on account of the twofold peculiarity of certain of the cells of which they were composed. Both of these peculiarities can be looked upon as inherited tendencies transmitted from the original ancestral cells of the chorion. The first is the almost invariable presence of large hemorrhages in the tumor nodules, due

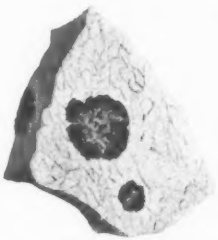


FIG. 5.—Metastases in the pancreas.

to the penetration of the bloodvessels by the rapidly growing cells; the second is the formation of syncytial masses, due in the opinion of some authors, to nuclear multiplication without corresponding division of protoplasm, hence producing large protoplasmic bodies with many nuclei. Somewhat similar bodies are seen in many other forms of malignant growth, but in none so conspicuously and consistently as in this form of neoplasm. The tumor tissue is in general made up of masses of spindle-shaped cells of ovoid type, with here and there a syncytial mass, and wherever found the tumor cells always are infiltrative in the extreme. This is especially well shown in the primary growth in the uterus where the muscle bundles are greatly separated and infiltrated by the tumor cells.

One espeecially interesting feature shown by the microscope is the peculiar difficulty in determining in the liver the difference between tumor masses and chains of liver cells. It is plainly evident that at one portion of the field there is tumor and at another liver, but the dividing line is impossible to place. This con-

dition of affairs is suggestive of the hypothesis that has been advanced that certain neoplasms may, in a tissue or organ, stimulate the parenchymatous cells to a sympathetic growth with the development of a new type of cell similar to that of the invading growth. Whether this can occur and whether there is in this an example of true metaplasia is questionable, and the exemplification found in this tumor is at most merely suggestive.

SPECIFIC IMMUNITY AND X-RAY THERAPEUTICS.[1]

By A. W. Crane, M.D.,
of Kalamazoo, Michigan.

The medical mind believes in specifics, but distrusts a panacea. Quinine in malaria, mercury in syphilis, and iron in anemia are articles of faith in the therapeutic catechism. Diphtheria antitoxin cures diphtheria and nothing else. But the *x*-ray is put forth by its votaries as a treatment for a list of diseased conditions which are even less astounding for their number than for the wide diversity in their pathology and causes. However, the earnest testimony of many competent and reliable observers has compelled attention. But the question remains: How can a single agent be of service in such a bewildering variety of cases?

Some of the methods by which unaided nature is able to bring about recovery from infectious diseases have been disclosed and demonstrated in the last few years. We now understand that the presence of a minute quantity of infectious material within the body calls into play a wonderful set of protective processes. The blood serum is supplied with antibodies as various as the infectious agents, while the leukocytes, increasing in number and power, pour into the field, like an army of the interior, to engage in a life and death struggle with the invaders.

While the subject of antibodies is exceedingly complex, Wright has shown that the phagocytic power of the leukocyte, by which it is able to ingest and destroy bacteria, depends on certain antibodies in the serum which so injure the germs that they become an easy prey to the voracious white blood cell. He has called these antibodies opsonins. He also devised a method by which the blood serum, leukocytes, and any given bacteria may be brought in contact and kept at blood heat for fifteen minutes, after which cover glass preparations of the mixture can be stained and examined under the

[1] Read at the annual meeting of the American Röntgen-ray Society, Cincinnati, October 4, 1907.

microscope. The average number of germs ingested per leukocyte, divided by the normal, gives the opsonic index.

This opsonic index is an ascertainable factor in the natural specific immunity which follows recovery from an infectious disease. It also explains how an artificial immunity, no less specific, may be induced by hypodermatic injections, in proper doses, of the bacterial substance. The consideration of dosage is of importance in following the parallel which this paper indicates between opsonic and *x*-ray therapeutics. Too small a dose of bacterial substance fails to bring about a reaction. But it is truly astonishing to consider how small a proper dose is. 0.0025 mg. of the tubercle substance is the beginning dose. The protective forces of the body are delicately poised; otherwise they could not respond to such slight infections as may come through cuts and scratches, in time to prevent general infection. But, on the contrary, for the same reasons, too large a dose of bacterial substance overwhelms the immunizing forces of the system and plunges the patient into the so-called negative phase from which he may or may not recover. Doses must follow one another at right intervals, or else the reactions are cumulative and overwhelming on the one hand or isolated and ineffectual on the other. The proper dose and the correct interval can be ascertained only by repeated examinations of the blood. Clinical symptoms alone cannot furnish a guide, because the rise and fall of the opsonic index do not produce definite or uniform clinical symptoms.

Opsonic therapeutics has been conspicuously successful in certain diseases which have also been treated with equally conspicuous success by the *x*-rays. Examples of such diseases are lupus, acne, and glandular tuberculosis. In looking over the long list of diseases treated by the *x*-rays, it will be noticed that the large majority are either diseases known to be parasitic, or diseases running such a course that analogy compels us to believe in a microbic cause yet undiscovered. The antiseptic power of the *x*-rays being a negligible quantity, it has occurred simultaneously to many *x*-ray workers in various parts of the world, myself included, that the therapeutic properties of the rays might lie in some power to stimulate the production of opsonins in general in the body fluids. With this idea in mind, I made cultures from several pustules in a case of acne of the face about to be treated, and found that the infectious agent was the common Staphylococcus pyogenes albus. I then made an estimate of the patient's opsonic index to this germ, after which *x*-ray treatments were begun.

One observes from the chart of this case (Fig. 1) that the opsonic index was low before treatment, the average number of germs per leukocyte being 1 and the percentage of active leukocytes being 62.[2] An *x*-ray exposure of fifteen minutes at a distance of six inches

[2] All opsonic estimations were made with a serum dilution of 1 to 20.

was given. On the next day the average number of bacteria per leukocyte had risen to 1.42 and the active leukocytes to 70 per cent. On the third day the number of germs per cell had increased 300 per cent. and the number of active leukocytes had increased 17 per cent. Then, on the fourth day we found a slight fall, so that when the patient appeared on the fifth day, we gave a second treatment like the first, all parts except the affected area being, as usual, carefully screened by lead foil. On the day of this second treatment the average number of bacteria per leukocyte was 2.20, and the percentage of active leukocytes 70; but on the next day the figures were 3.18 and 92 per cent., and on the day following, which was the seventh day from the beginning treatment, the figures stood 5.20 and 96 per cent.; and on the eighth day, 8.70 and 100 per cent. of

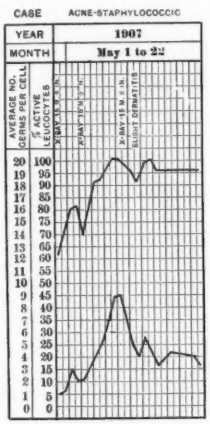


FIG. 1.—Upper curve = percentage of active leukocytes. Lower curve = average number of bacteria per cell.

active leukocytes. On the ninth day the figures were 8.76 and 100 per cent., or an increase in phagocytic power of 876 per cent. over the beginning figure. The patient's face had completely cleared. Only brownish discolorations remained where the pustules had been. The patient had acquired, by some action of the *x*-rays, a specific immunity to Staphylococcus pyogenes albus.

On the tenth day, in obedience to an opsonic fall, we gave a third treatment. But there was no longer an acne to treat, and it is significant to note that the average number of bacteria per leukocyte declined to about 4 and the percentage of active leukocytes to about 96, where they remained as normal constants. The patient remains well up to date, and it is safe to predict that so long as his specific immunity endures he will be free from staphylococcic acne.

During the treatment of this case we made several estimations of the opsonic index to the tubercle bacillus, but we found that even at the height of the staphylococcic reaction the tuberculo-opsonic index remained unchanged.

The next case was one of lupus of the face, a small ulcer an inch in diameter on the temple (Fig. 2).

One observes a prompt rise after each treatment until the fourth, when there is a general decline until the seventh, when a rise again occurs. During this prolonged negative phase the lupus ulcer remained stationary, but with the upward swing of the opsonic index there occurred a rapid shrinking of the patch. With more

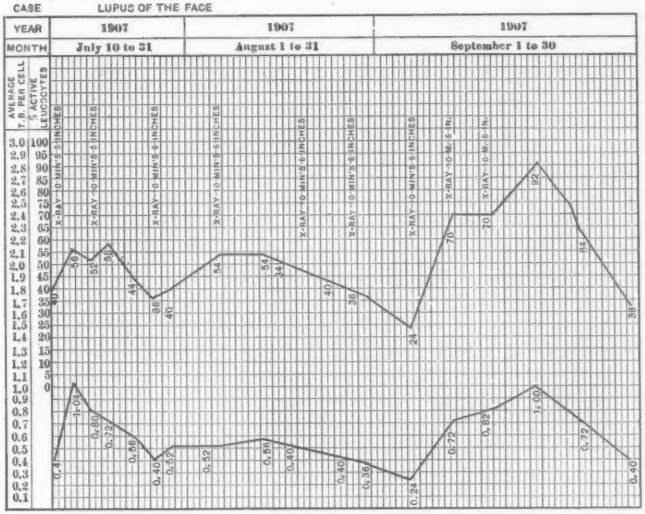
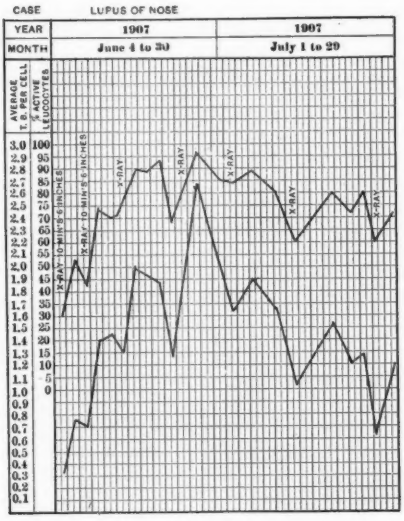


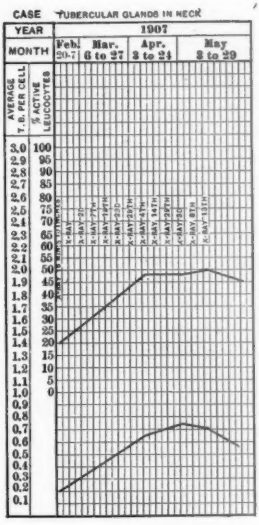
FIG. 2.—Upper curve = percentage of active leukocytes. Lower curve = average number of bacteria per cell.

experience on my part I could have regulated the *x*-ray dosage in more accurate accordance with the blood findings. As it was, the falling index restrained me from pushing the *x*-ray treatments as would usually be done when no dermatitis or skin reaction showed. Had the treatments been pushed, it is my opinion that the ulceration, which had been present ten years, would never have healed, but would have been classed as one of the inexplicable cases not amenable to *x*-ray treatment. After the fourth treatment I should have waited several weeks, if necessary, until some slight opsonic reaction occurred, and then, by smaller doses, should have nursed one small reaction after another, until a fair degree of immunity had been obtained. It is quite possible that in such cases we should

be satisfied with a very moderate index, because, when the protective forces are feeble, the induction of high indices might easily lead to the exhaustion of the opsonin producing tissues, with the sudden relapse of the case, as *x*-ray operators sometimes see, without being able to furnish any adequate explanation.

The most striking case I have to offer is one of lupus of the nose. Seven *x*-ray treatments were given (Fig. 3). One sees that the tuberculo-opsonic index was low in the beginning. After each *x*-ray treatment there was a prompt jump in the index, until after the fourth treatment (twenty-two days from the beginning), the average





FIGS. 3 and 4.—Upper curve = percentage of active leukocytes. Lower curve= average number of bacteria per cell.

number of tubercle bacilli per leukocyte had increased nearly seven and one-half times, and the active leukocytes had increased from 30 to 96 per cent. The lupus patch had healed, and from this time on the index gradually declined in spite of *x*-ray treatments.

Although I have been giving *x*-ray treatments from the first years of its employment as a therapeutic agent, I never before obtained such successful results with so few treatments and in so short a time. By analogy with our opsonic work I should attribute these results to the careful timing of the treatments. The opsonic estimations enabled us to give each treatment just as the positive phase began to decline.

The last case was one of tuberculous glands in the neck of a boy

aged ten years. The patient had seven *x*-ray treatments before the opsonic estimations were begun (Fig. 4). One notices that the beginning figures are very low, but that under *x*-ray treatments a steady rise in the tuberculo-opsonic index is produced from February 20 until May 1, when a moderate fall occurs. By May 1, however, the glandular enlargements had disappeared, inasmuch as what was left were two very small, hard nodules representing the permanent remains familiar to *x*-ray therapeutists. The moderate degree of immunity obtained in this case is sufficient, and the patient remains free from tuberculosis.

In all these cases we see that the *x*-rays ceased to raise the index when the infectious agent was presumably eliminated; and furthermore that the index is raised only for germs present in the lesion. That is to say, the *x*-rays do not appear to stimulate the production of opsonins for bacteria in general, but only for those in living tissues brought directly under their influence. The charts of opsonic indices during *x*-ray treatments and the charts during opsonic vaccinations are similar in all essential particulars. The time of reaction after therapeutic application; the succession of negative and positive phases; the interval required between treatments, would seem to be too closely parallel to be accidental. The concomitant variations seem to prove a common cause; and the common cause seems to be the liberation, in the body fluids, of the immunizing substance of the disease-producing agent.

This is what is done in opsonic practice, and this is what the *x*-rays seem to do at the site of exposure. These principles, if they hold at all, will hold as well for cancer as for tuberculosis. In fact, if applicable, they must apply to all cases in which there is pathological material to which the body may react. Thus may we explain the tremendous negative phase which so often occurs after exposure of sarcoma to the *x*-rays. Equally well may we explain why we sometimes fail to cure in forty treatments the same sort of case that in another patient we cure in ten. That is to say, if our hypotheses are correct, we may, in one case, owing to the individual reaction from too frequent or too severe exposures, easily throw the patient into a succession of negative phases which prevent recovery. Or, in another case, we may fail, by too weak exposures, to liberate the immunizing substances; in which case frequency of exposures will not avail.

If I am permitted to draw conclusions from my limited data, I should suggest:

1. That all *x*-ray treatments, to be effectual, may require a degree of intensity sufficient to set free in the tissues what is equivalent to an autogenous vaccination.

2. That the duration of the exposure and the extent of the diseased tissue exposed should be so regulated as to induce either a small negative phase or none at all.

3. That the repetition of exposures, as far as possible, should be governed by the duration of the negative and positive phases; and that in diseases of which the disease-producing agent is as yet undetermined, one should be governed by analogy with those cases in which opsonic estimations can be made.

It follows as a corollary that it is not necessary to expose the whole area in order to bring about complete recovery, and that exposure should not, as a rule, be repeated oftener than twice a week, and probably usually at less frequent intervals, to get the maximum results and to avoid prolonged or incurable negative phases. It is also increasingly necessary to measure our *x*-ray dosage. In this respect *x*-ray therapeutics is lacking in precision. No method has yet been made practicable by which we may exactly specify the quality and quantity of the *x*-ray dose.

The advantage of *x*-ray treatments over opsonic therapeutics is considerable:

1. The immunizing substance set free under the influence of the *x*-rays is of necessity autogenous; that is, it is formed from the actual microbic strain which is producing the disease. One has only to read Wright's articles to learn how important it is in opsonic practice to use a vaccine made of the bacteria from the patient rather than from a stock culture.

2. Many of the difficulties and mistakes incident to a bacteriological diagnosis are eliminated.

3. In cases in which the bacteriological cause is as yet undetermined, or in which the disease-producing agents are not bacteria, the *x*-rays are nevertheless applicable.

In conclusion, I must state I am well aware that I have carried my deductions and conclusions far beyond the limits warranted by the number of cases I have to report. My excuse is, to set the subject, along with obvious hypotheses, squarely before the profession, in the hope that other workers may be invited into what has seemed to me a fertile field of therapeutic endeavor.

REVIEWS.

A Text-book of Pharmacology. By Torald Sollman, M.D., Professor of Pharmacology and Materia Medica in the Medical Department of the Western Reserve University, Cleveland, Ohio. Second edition; pp. 1070; 127 illustrations. Philadelphia and London: W. B. Saunders Company, 1906.

A Practical Treatise on Materia Medica and Therapeutics. By John V. Shoemaker, M.D., LL.D., Professor of Materia Medica, Pharmacology, Therapeutics, and Clinical Medicine in the Medico-Chirurgical College, Philadelphia. Sixth edition; pp. 1255. Philadelphia: F. A. Davis Company, 1906.

Materia Medica and Therapeutics. By J. Mitchell Bruce, M.A., LL.D., M.D., Consulting Physician to the Charing Cross Hospital, London. Revised edition; pp. 632. Chicago: W. T. Keener & Co., 1906.

A Treatise on Materia Medica and Therapeutics. By Rakhaldas Ghosh, L.M.S. (Cal. Univ.), Lecturer on Materia Medica in the Calcutta Medical School, Calcutta, India. Edited by C. P. Lukis, M.D., Dean of the Faculty of Medicine of the University of Calcutta. Third edition; pp. 737. Calcutta: Hilton & Co., 1906.

Materia Medica, Therapeutics, Pharmacology, and Pharmacognosy. By William Schleif, Ph.G., M.D., Demonstrator of Medical Pharmacy in the University of Pennsylvania. Third edition; pp. 470. Philadelphia and New York: Lea Brothers & Co., 1907.

A Manual of Medical Treatment or Clinical Therapeutics. By I. Burney Yeo, M.D., F.R.C.P., Emeritus Professor of Medicine in King's College, London. Fourteenth edition; 2 volumes, pp. 696, 818. Chicago: W. T. Keener & Co., 1906.

It is said by Ghosh that "materia medica is not an attractive subject, but it must be learnt." That the necessary labor is great no one doubts who has picked his way through its mazes; but he that desires a trustworthy guide to its devious ways may have recourse confidently to the aforementioned books—all of which are new editions of well-known volumes, and have been revised to accord with the new Pharmacopœia.

Sollman's *Pharmacology*, which comprises not only pharmacology,

but also therapeutics, materia medica, pharmacy, prescription writing, toxicology, outlines for laboratory work, etc., has been thoroughly revised, in large part rewritten, and considerably enlarged. The revision has been thorough, as is apparent on almost every page and in the many references to very recent research and other work. The classification of drugs adopted is somewhat unusual, but the descriptions of the actions of drugs are very good, albeit more from the point of view of pharmacology than of therapeutics. Especial attention has been given to the section on laboratory work—which has been much amplified. Since pharmacology nowadays is taught largely as a laboratory exercise, the systematized course outlined in the book, which includes a description of technique and apparatus, should prove of much value to the teacher as well as the student; to make it as practical and adaptable as possible, it has been made quite distinct from the text, to which, however, it should be considered introductory. Proprietary remedies are discussed in a sane manner. Quite an unusual amount of space is devoted to toxicology, but the section is excellent, dealing with symptoms, etiology, isolation, and treatment of poisoning, while the symptoms and treatment are also discussed under the heading of each drug. The incorporation of bibliographical references must be mentioned as another useful addition. The weakest point in the book consists of the references to therapeutics. Although this might be deemed excusable, in view of the wealth of information on other topics, the rather slighting references to the therapeutics of important drugs, such as arsenic, iron, digitalis, opium, etc., cannot escape comment, and some of the therapeutic recommendations are at least subject to debate; but the very worthy endeavor has been made throughout to base therapeutics on the results of pharmacological research. On the whole the book is excellent, and will well repay perusal by the student, teacher, and practitioner interested in pharmacology and allied subjects.

Shoemaker's *Materia Medica and Therapeutics*, now in its sixth edition, has been before the medical public for a long time, and has served a very useful purpose. The new edition does not differ in general arrangement from its predecessors; but the book has been carefully revised and enlarged by about 100 pages; a new section dealing with general considerations concerning remedies and systems of therapeutics has been added; and discussions of the therapeutics of new agents, such as the Röntgen rays, the Finsen light, serumtherapy, animal extracts, vibrotherapy, hydrotherapy, etc., have been introduced. The book doubtless will continue to maintain its well-established reputation.

Bruce's *Materia Medica and Therapeutics* is one of the best books on the subject, but it needs not the reviewer's words to establish the fact, since the publication of 49,000 copies since 1884 amply attests it. The book is small, which is in many respects an advantage;

the arrangement is much to be commended, and the treatment of the subject matter is all that could be desired. The different drugs are considered under the headings of immediate local actions and uses, actions on the blood, specific actions and uses, remote local actions and uses, and the uses of the different preparations, all of which must appeal to the student. The last section in the book—on general therapeutics—has long impressed the reviewer as one of the most valuable in any book. Taking up the systems of organs in order, Dr. Bruce discusses physiological relations, pharmacodynamics, pathological relations, natural prevention and recovery, and therapeutics. All of this is much condensed, but it is readable, sound, and very practical. Though the book may be considered a trifle out of date in some places, happy were most of us if we knew all that it contains. The present edition has been adapted to the United States Pharmacopœia by Oscar Oldberg.

Ghosh's *Materia Medica and Therapeutics* is an excellent book, thoroughly adapted to the purpose in view. However, since it does not differ materially from, nor is it superior to, other books on the same subject, there is little likelihood that it will displace them in this country; but it might be used with advantage in conjunction with them. The "prescribing hints" appended to the descriptions of important drugs are an especially attractive feature; they suggest the best ways of administering drugs so as to make them most palatable as well as most efficacious.

Schleif's *Materia Medica, Therapeutics, Pharmacology, and Pharmacognosy* has firmly established for itself a reputation as an excellent book for the student and junior practitioner. It comprises not only a discussion of the physical properties, physiological action, therapeutics, and toxicology of each medicinal agent, but also chapters on prescription writing, medical Latin, medical pharmacy, practical anesthesia, tables of doses, of poisons and antidotes, and of incompatibilities, and a therapeutic index of diseases and remedies. The new edition has been thoroughly revised, metric equivalents have been introduced throughout, references to sixty new drugs have been included, and the book has been increased in size by about 100 pages. The book has been considerably enhanced in value, and continues to merit the confidence of students and teachers.

Yeo's *Medical Treatment* is a book conspicuously devoted to treatment. Materia medica, as such, is not discussed, although the different means of treatment are mentioned in sufficient detail as occasion warrants, and many of the sections are enlivened by more or less discussion of symptoms which, though scarcely germane to the subject, serves the very useful and practical purpose of enabling the author to suggest valuable hints in treatment looking toward not only the cure of the disease, but also the alleviation of symptoms. Most of the treatment suggested is excellent, being born of a wide experience, and it can be safely adopted with assurance of happy

results; some of it may be looked upon as old fashioned by the eager and alert young physician; a little of it runs counter to the practice of the most progressive physicans of this country. Doubtless we should not expect encomiums of the Brand treatment of typhoid fever, since it has not been thoroughly tried in England, but at this day scarcely anyone except Dr. Yeo believes in the efficacy of chlorine water. The advocacy of no haste in resorting to paracentesis in pleuritis is not in accord with the best modern practice. The absence of specific reference to hyperchlorhydria, achylia gastrica, and gastroptosis seems worthy of comment, as does also Dr. Yeo's marked discountenance of operation in all cases of appendicitis. However, 22,000 copies issued attest the practical usefulness of the book, and speak more than words of its value to many practitioners. Oscar Oldberg has adapted the present edition to the standard of strength of preparations employed in America. A. K.

AMERICAN PRACTICE OF SURGERY. Edited by Joseph D. Bryant, M.D., and ALBERT H. BUCK, M.D., of New York City. In eight volumes. Vol. III, pp. 775, with 311 illustrations. New York: William Wood & Co., 1907.

IN the third volume of the *American Practice of Surgery* is begun the study of the various systems of the body, that of the bony skeleton being first discussed. There are prefixed, however, as Part XI, two articles which properly belong in an earlier volume, and which logically should follow close upon the inflammatory process. These are treatises on poisoned wounds, by Major Charles F. Mason, U. S. A., and on rabies, by Dr. George G. Rambaud, of New York. Under the former heading are included such diseases as glanders, anthrax, tetanus, malignant œdema, etc., all of which have been discussed—many of them twice—in Volume II. The subscribers would have just cause for complaint in this apparent "padding," did not the thought arise that the editors, recognizing the deficiencies in some of the earlier articles, are now endeavoring to make amends; but the accounts already given of glanders, anthrax, and similar diseases need no supplement; and it is to be regretted that Major Mason could not have written the only account of such affections as erysipelas, tetanus, malignant œdema, etc., since even the terse descriptions he here furnishes are evidence of ability for greater things.

Rambaud's article on rabies is what might have been expected from his pen: being the director of the Pasteur Institute, it is but natural that he should advocate prophylactic inoculation, and that his views of the pathology of the disease should be tinctured by those

of Pasteur himself. He denies the specificity of the Negri bodies, and maintains that the cause is not a protozoon, but an extremely minute bacterium. It is, on the whole, a temperate account of rabies, and parties on both extremes would do well, we think, to remember the Horatian motto: "*Est modus in rebus.*"

Part XII includes fractures, by Duncan Eve, of Nashville; pseudarthrosis, by T. Turner Thomas, of Philadelphia; inflammatory affections of bone, by Peters, of Toronto, whose recent death will be widely regretted; non-inflammatory affections of bones, by Roswell Park; syphilitic disease of the bones, by Horsley, of Richmond; and tumors originating in bone, by Simmons, of Boston. Part XIII, diseases and injuries of joints, includes chronic non-tuberculous and non-traumatic inflammations of joints, by Charles F. Painter, of Boston; tuberculous disease of the bones and joints, by Alexander Primrose, of Toronto; and wounds of joints, by John Chadwick Oliver, of Cincinnati.

In the whole surgery of the osseous system, two articles are conspicuous by merit—those on pseudarthrosis and on tuberculous disease of the bones and joints. The article of fractures is distinctly disappointing. What little progress has been made in the pathology, diagnosis, and treatment of fractures within the last generation is owing almost entirely to the Röntgen-rays and the results of operative experience; and good results are to be obtained in this important branch of surgery only by strict attention to minute details. In the latter the present article is in our judgment deficient; and in regard to the former it can only be said that the illustrations employed are most of them hallowed by age, and, what by no means follows as a corollary, they are mostly bad illustrations, from both an artistic and a scientific point of view. That fractures of the elbow "nearly always justify" the use of ether for diagnosis we do not admit; and although, with apologies to the King's English, it may be that while the patient is under the influence of this drug "it likely will be possible" to make a correct diagnosis and to reduce the fracture, we consider a resort to etherization, except under very exceptional circumstances, rather a confession of incompetence on the surgeon's part than a proof of the complicated nature of the fracture. That fractures of the carpus are rare has been disproved by the studies of Dr. G. G. Ross, of this city; and that padding to preserve the interosseous space in the forearm is either necessary or desirable we do not believe. The account of fracture of the femoral neck is antiquated, and the tables showing the differential diagnosis between intracapsular and extracapsular fractures could well have been omitted, since modern study has shown that such a differentiation is immaterial because practically all such fractures are partly intracapsular and partly extracapsular. The reference to the so-called "Maxwell treatment" by lateral traction reminds the reviewer that this method was accurately described and illustrated

by Dr. G. W. Phillips, of Illinois, in the pages of this JOURNAL in 1869 (vol. lviii, p. 398). The description of fractures of the shaft of the femur is distressingly inadequate, and twice the space is devoted to fratures of the patella. Philadelphia surgeons will miss all references to the fracture box.

Dr. Thomas's article on pseudarthrosis is one of the best in the volume—orderly, concise, and sufficiently encyclopedic. Should any criticism be offered, it is perhaps in the choice of title, since the pathological condition he is describing very rarely constitutes a true false joint; ununited fracture is a more accurate designation, and we would prefer to reserve the term pseudarthrosis for those rare cases in which a bursa has formed between the ends of the fractured bones. Possibly a little more stress might have been laid on failure properly to immobilize the fragments as a cause of non-union, and on the value of massage in arousing osteogenetic processes when prolonged immobilization fails to produce union. Thomas shows a marked preference for the Parkhill clamps. It is a pity that no description of operative technique is included; in our own opinion the difficulty of these operations consists in the surgeon's failure to provide a proper armamentarium. The use of chromic-gut bone sutures is not mentioned; yet Macewen, certainly a past-master in bone surgery, uses no others. And to prevent the necessity of removing wire sutures later, it is not sufficient merely to "press" the twisted ends against the bone—they should be hammered into the bone, so as to ensure their being covered by the periosteum. But even with these few exceptions, the present article on ununited fractures is as judicious, straightforward, and modern an account of the condition as any known to the reviewer.

Dr. Peters's description of inflammatory affections of bone is a valuable contribution to the subject, the sections on etiology and pathology being particularly praiseworthy. In regard to treatment, Dr. Peters seems a little too timid in advising operations in acute osteomyelitis. He thinks two trephine holes at the extremities of the long bone affected afford sufficient opening, and that irrigation from one to the other will be sufficient. He discountenances operations of *évidement*, or guttering, as he calls it, and is perhaps overcautious in resort to Mosetig-Moorhof's bone-filling. We believe ourselves that the patient's life is frequently jeopardized by the timidity of a surgeon, not only in failing to remove all the diseased bone, but in leaving behind overhanging edges of bone which if left will materially hinder the granulation of the wound, as well as tend to the production of new sequestra. In chronic inflammatory diseases of bone of non-tuberculous type, the iodoform-wax filling deserves to be more used in this country than has hitherto been the case.

Roswell Park, in treating of non-inflammatory diseases of bone, has probably the most difficult subject in the whole volume. He

excludes the terms "rheumatism" and "rheumatic" from any connection with bones and their diseases; and does not attempt even a sketch of treatment. The whole article is a rather desultory disquisition on the nature of the non-inflammatory affections of bone.

Tumors originating in bone are discussed by Dr. Simmons. The same problems as to classification and terminology arise here that perplexed the reader in the first volume. Referring to exostoses of the accessory sinuses, Simmons states that Virchow termed them *endostomata*. The great master of pathology would have been grieved to see himself inaccurately quoted, and in a way which only adds confusion to the nomenclature of tumors. Virchow described this condition as endostosis—a term analogous to exostosis. Endosteoma, referring to bony tumors arising in the centre of a bone, would be better than endostoma, although the latter is found in dictionaries.

Painter, in discussing non-tuberculous inflammations of joints, adopts the classification of Goldthwait, which, although sufficient for a working hypothesis, is not scientifically accurate. In this classification these diseases are divided into: (1) Infectious; (2) atrophic; and (3) hypertrophic; the first being based on the etiology, while the second and third are based on the pathology of the disease. The classification proposed by Nathans is more logical, in that under the terms infectious and metabolic all joint diseases are classed according to etiology. In spite of the limitations of our knowledge, Painter has prepared a very lucid account of these diseases, and one which shows how further progress may be attained. This is all that can be expected, and the author is to be sincerely congratulated on his work. One egregious error, however, should not have escaped detection: it is that of referring in the text to skiagrams of a hemophilic elbow as taken from "a young man," when a glance at the illustrations (Figs. 245 and 246) shows the elbow actually figured to have been one of a child certainly under six years of age.

Without any doubt the best article in this volume is that on tuberculosis of the bones and joints, by Primrose. It is too long for us to analyze, and we can only regret that Pott's disease of the spine has not been included. It is gratifying to realize that surgery has so far progressed that excisions of the larger joints for tuberculosis are now becoming rare operations. As in many other departments of surgery, real progress in bone surgery is slow; but we have long passed the time when amputation was the only remedy short of death; we are now seeing excision pass; and when we get enough roof-gardens and country branches for our hospitals, patients with tuberculous bone disease will get well without operation.

A. P. C. A.

PROGRESSIVE MEDICINE. A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES, AND IMPROVEMENTS IN THE MEDICAL AND SURGICAL SCIENCES. Edited by HOBART AMORY HARE, M.D., Professor of Therapeutics and Materia Medica in the Jefferson Medical College. Assisted bv H. R. M. LANDIS, M.D., Demonstrator of Clinical Medicine in the Jefferson Medical College, Philadelphia. Vol. IV, December, 1907; pp. 336. Philadelphia and New York: Lea Brothers & Co., 1907.

VOL. IV of the series for 1907 of *Progressive Medicine* opens with a critical discussion of recent advances in diseases of the digestive tract and allied organs, the liver and the pancreas, by J. Dutton Steele. The most important contributions consist of the normal and morbid physiology of the digestive tract, the action of alcohol on the stomach, the morbid physiology of visceral pain, facts about digestive ferments, gastric carcinoma, gastric ulcer, chronic autointoxication of intestinal origin, the determining the total amount of fecal bacteria by weight, the value of intestinal antiseptics, true intestinal dyspepsia, infections of the biliary tract, cholecystitis, cholelithiasis, chronic icterus, and acute necrosis and hemorrhage of the pancreas. These comprise 95 pages of exceedingly useful information, well digested, clearly epitomized, and interestingly presented. Dr. John Rose Bradford discusses diseases of the kidneys—22 pages. Among other topics, the following are critically discussed: Hydronephrosis, renal tumors in children, arteriosclerosis of the renal arteries, increased arterial tension and renal disease, experimental arterial degeneration, renal extracts, renal hematuria, the functional activity of the kidney, and hydremia. Dr. Joseph C. Bloodgood contributes a chapter of 90 pages on the surgery of the extremities, fractures, dislocations, tumors, surgery of the joints, shock, anesthesia, and infections. Among the many important subjects discussed are scopolamine-morphine narcosis, spinal anesthesia, Bier's passive hyperemia treatment, divers diseases of the bones and joints, and the very important subject of tumors—the last mentioned being well illustrated. Dr. William T. Belfield contributes a chapter of 31 pages on genitourinary diseases, discussing, among other topics, hematuria, renal pain, nephritis caused by surgical lesions, ureteral occlusion, ulceration and carcinoma of the bladder, enlargement of the prostate, tumors and other enlargements of the testicle, and gonorrhœa. Finally, Dr. H. R. M. Landis contributes an extremely valuable and interesting chapter on recent progress in therapeutics—69 pages—which, to be properly appraised, must be read. Altogether, the volume is a valuable member of an exceedingly valuable series—a virtual necessity in these days of rapid progress. Assuredly, nowhere else are progress and advances in medicine better or more promptly recorded. A. K.

DISEASES OF THE LUNGS. By ROBERT H. BABCOCK, A.M., M.D., Recently Professor of Clinical Medicine and Diseases of the Chest, College of Physicians and Surgeons, Chicago, Illinois. Pp. 809; 12 colored plates and 104 text illustrations. New York and London: D. Appleton & Co., 1907.

DR. BABCOCK'S *Diseases of the Lungs* is designed to be a practical presentation of the subject for the use of students and practitioners of medicine, and is issued as a companion volume to his well-known book on diseases of the heart and arterial system, published in 1903. The arrangement of the book is that which is quite familiar. The first 68 pages are devoted to the different forms of bronchitis, the etiology, diagnosis, and treatment being discussed in quite satisfactory detail. The chapter on bronchiectatsis, reflecting largely the opinions of Carr, Marfan, Hoffmann, and Lenhartz, but also the author's personal experience, is of much interest; but some reference might have been made to the postural treatment, undoubtedly of much service. A special chapter (28 pages) is devoted to pulmonary hemorrhage. The discussion of the causes, which include the influence of the nervous system, is very good. The most efficient means for the arrest of profuse hemorrhage is said to be atropine sulphate, $\frac{1}{50}$ to $\frac{1}{25}$ grain hypodermically. The advantages of morphine also are pointed out. Nitroglycerin is not recommended, on account of its initial action in quickening the heart's action and the consequent possibility of a thrombus being dislodged; but assuredly it has the effect claimed for atropine—that of reducing the pulmonary blood pressure by causing vasodilatation in the systemic circulation, and its use has been attended by good results clinically. The use of ergot and drugs of like action is rightly condemned.

In reviewing a book on diseases of the lungs one instinctively turns to the sections on pneumonia and tuberculosis. To pneumonia Dr. Babcock devotes 128 pages; to broncho-pneumonia, 31 pages; and to tuberculosis, 215 pages. His views with regard to the etiology of pneumonia are sound, the disease being looked upon as an infection, and the influence of cold being said to be to impair or destroy the protective power of the bronchial or pulmonary epithelium by occasioning some chemical or biological change in the cells by virtue of which the pneumococcus is enabled to find suitable soil for its growth. The chapters on the symptomatology, the physical signs, and the clinical varieties are excellent. The treatment recommended is what is generally known as the expectant, which is very well outlined. He suggests that the high mortality of the disease in hospitals is due to lack of hygienic conditions, especially lack of fresh air; he recommends that the air supplied to the lungs should be as pure and cool as possible, and that if necessary the nurses wear warm wraps or keep a fire in the grate, if there be one. He believes that even a draught is less dangerous than lack of proper ventilation; that

nothing is more absurd than to see an oxygen apparatus in a room the windows and doors of which are closed and the atmosphere stifling from heat and foul emanations from the patient and attendants; and that the cotton jacket is an abomination, a relic of ignorance, and a device calculated to prevent radiation of body heat, to augment the sufferer's discomfort, to retain sour-smelling sweat, and to interfere with and, hence, occasion neglect of those frequent chest examinations without which one cannot keep track of the progress of the disease. The use of veratrum viride and aconite is condemned; cold is said to be the best antipyretic; digitalis is recommended as a heart tonic; and it is said that alcohol may do good if the pulse begins to grow in frequency and the heart sounds to become weak, short, and perhaps impure, while cyanosis is not very widespread and intense and pulse-tension has not yet fallen to a noticeably low ebb, but that it is theoretically contraindicated if cyanosis of a more than usually pronounced type precedes the acceleration and enfeeblement of the pulse. There are other equally sound views.

The chapters on tuberculosis are excellent; perhaps the best in the book. Emphasis is laid on the idea of the disease being due to infection rather than to hereditary influence; the symptomatology and physical signs are well described; every one might read with profit the chapter on diagnosis; and the chapters on prevention and treatment contain all that is modern. There is an interesting though short chapter on pulmonary syphilis.

The chapters on diseases of the pleura suffer somewhat by condensation, only 70 pages being devoted to them. What there is, however, is very good. Examples of the author's progressiveness are found in the statement that he regards all so-called primary pleurisies as due to the tubercle bacillus or the pneumococcus, to the tubercle bacillus if the exudate be serofibrinous, until proved otherwise; and in the fact that he recommends early aspiration in the treatment of the disease.

The book is to be cordially recommended. It is, undoubtedly, one of the best on the subject at our command—well thought out, excellently arranged, written in a fluent and limpid style that renders reading easy and pleasant, and replete with practical suggestions relating to diagnosis and treatment that must appeal to the general practitioner. A. K.

FOODS AND THEIR ADULTERATION. By HARVEY W. WYLIE, M.D., Ph.D. Philadelphia: P. Blakiston's Son & Co., 1907.

PUBLICATIONS that tend to lead to greater familiarity with dietetics and a more proper use of dietetics in the treatment of the sick are exceedingly valuable and desirable. Among medical men, dietetics is used with much less regularity and much less skill than are most of the other important measures that are employed in the treatment

of the sick, and yet no one questions the fact that skilfully used diet has, in many conditions, an effect equal to or, at times, greater than other measures. One thing that is largely influential in preventing the skilful and regular use of proper diet is a lack of knowledge of food values and the composition of foods; so that a large proportion of persons, in regulating the diet, do so chiefly upon the basis of merely recommending certain food-preparations that they have been taught to believe are suitable in the condition at hand; while the rational manner of carrying out this matter is, of course, to have a comprehension of foods and their character and composition, just as one has a comprehension of the character, composition, and physiological action of drugs. The only way to do this is to acquire a knowledge of the chemistry of foods and of their value when taken into the organism.

Dr. Wylie's book will be a valuable source of reference to persons who desire to acquire this exceedingly important knowledge of foods and their composition, and likewise is an authoritative discussion of the origin and manufacture of foods and food-products, and an important description of adulterations, together with a discussion of the national food-laws and regulations. He takes up a consideration of the proper food-ration, the functions served by foods, and their classification; and then explains the chemical terms used in describing foods. He goes into a complete discussion of the various kinds of foods, such as meat, poultry, eggs, fish, milk, and milk-products, cereals, vegetables, etc. He then considers the manner in which these foods are prepared for use; the names of parts that are used, as in meats, the manner in which the foods should be cared for, stored, and delivered; the way in which they may be preserved; the general processes by which some of them may be most properly prepared for the table; and various similar points. As a work of reference, to physicians in particular, in connection with their use of diet, the book is one that is very opportune and valuable.

D. L. E.

THE COMMONER DISEASES OF THE EYE: HOW TO DETECT AND HOW TO TREAT THEM. By CASEY A. WOOD, M.D., C.M., D.C.L., Professor of Ophthalmology, Northwestern University Medical School, and THOMAS A. WOODRUFF, M.D., C.M., L.R.C.P. (Lond.), Ophthalmic Surgeon to St. Luke's Hospital, Chicago. Third edition; pp. 598; 280 text illustrations, and 8 colored plates. Chicago: W. T. Keener & Co., 1907.

THIS is a well written type of the shorter treatises upon the eye, and may be unhesitatingly recommended to those who require such a book. While it has many hints, such as the methods of recognizing the commoner forms of ophthalmia, intended more especially for the general practitioner, it will not, of course, by itself make an

oculist out of that much-talked-of and bewritten individual. The accounts of the method of performing the various operations in the surgical maladies of the eye are clear enough for the reader who is prepared by previous information to comprehend the subject, and many general practitioners may gain enough from the descriptions to acquire an intelligent idea of the methods of ophthalmic surgery. The illustrations, many of which are original, are a valuable part of the work. Three editions in as many years is good evidence that the book has made its way. T. B. S.

MANUAL OF THE DISEASES OF THE EYE. FOR STUDENTS AND GENERAL PRACTITIONERS. By CHARLES H. MAY, M.D., Ophthalmic Surgeon to the City Hospitals, Randall's Island, New York. Fifth edition; pp. 391; 362 illustrations, including 22 plates, and with 62 colored figures. New York: William Wood & Co., 1907.

WHEN we read that the first edition of this work appeared in the fall of 1900, that a fifth edition is now required, and that translations and editions have been prepared for the six leading nations of Europe. we have a concert of testimony as to its merits more convincing than the opinion of any single reviewer. So far as the subject can be presented in a manual of its size, the work contains in a lucid and easy style about all that is to be said upon the subject. Individual opinions, of course, will vary upon particular points, and no writer can be expected to be in complete agreement with every other worker in the same field; but, all things considered, the work is worthy of the exceptional success it has attained. T. B. S.

ATLAS AND TEXT-BOOK OF HUMAN ANATOMY. By DR. JOHANNES SOBOTTA, Professor of Anatomy in the University of Würzburg. Edited, with additions, by J. PLAYFAIR MCMURRICH, A.M., Ph.D., Professor of Anatomy in the University of Michigan. Vol. II; pp. 194; 214 illustrations, mostly in colors. Philadelphia and London: W. B. Saunders Co., 1907.

WE have already drawn attention to the excellence of Sobotta and McMurrich's *Atlas and Text-book of Human Anatomy* when noting the publication of Volume I. Volume II treats of the viscera and the heart, and in every way is quite as excellent as Volume I. The illustrations are examples of what may be accomplished by multicolored lithography, the three-colored process, colored half-tones, etc.; they are really unsurpassed, not only from an artistic point of view, but also from that of anatomical fidelity. As is quite appropriate in an atlas, the text is somewhat subordinate to the illustrations, but it is eminently satisfactory. The unusual value of the book, suggested by Volume I, is fully sustained by Volume II; the atlas is undoubtedly one of the very best. A. K.

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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Percussion in the Diagnosis of Respiratory Disease.—R. W. PHILLIP (*Edin. Med. Jour.*, 1907, xxii, 473) says that percussion serves not merely as a determinant of the size of the lung, and of its consistence at a given area—normal, infiltrated, excavated, or otherwise—but it affords a most valuable physiological test of the functional activity of the organ. For this latter determination Phillip uses a method which he calls "tidal percussion." This consists of the practice of percussion alternately during expiration and full inspiration. For early diagnosis this is especially valuable at the apices; but it is also helpful at the bases and anterior edges. In health the rise in the upper limit of resonance above the clavicles is quite marked during deep inspiration, and all degrees of variation may be found in this rise, depending upon how much the lung is affected; it may be of special value when only one apex is involved, as one then has the normal increase in resonance on the opposite side to compare with. Phillip asserts that by this method differences in the resonance of the extreme apices and bases can be easily determined, and that, especially at the apices, this change in pulmonary resonance should be carefully estimated by carrying our percussion higher above the clavicle than is done with the usual perfunctory percussion, either directly over the clavicle or only one finger's breadth above it. His method is to place the finger horizontally across the apex of the lung from back to front in a plane at right angles to the vertical diameter of the lung. (This is illustrated in the article, as is also the change noted in the size of the apex in different conditions.) During the progress of the disease much information may be obtained in respect to prognosis. Phillip says: "As the disease becomes arrested a considerable increase in degree and extent of resonance during full inspiration is frequently observed. Such a return of the ampler tidal

resonance affords one of the most satisfactory indications of improvement. On the other hand, as the disease advances, the amount of tidal percussion then is reduced still further."

Epidemic Pneumonia.—MARSHAL FABYAN (*Johns Hopkins Hospital Bulletin*, 1907, xviii, 439). The fact that pneumonia may occur at times in peculiar groupings and spread as if by direct contagion is of considerable interest; such epidemics have been reported often. Fabyan reports the cases of a family of ten people, six of whom developed acute lobar pneumonia within a period of ten days. Only two of the family escaped being sick at all, one of whom lived away from home and only returned for a while to nurse the others. The father of the family had been ill with a "cold," hoarseness, and abdominal pain three days before the onset of the first case of pneumonia; and although pneumonia was not definitely recognized, he may have been the source of the infection for the family. The conditions under which the patients lived were bad. It is interesting that when two of the patients slept together the second infection followed the first in every case in from six to nine days. One case, that of a girl aged fourteen years, was fatal. Fabyan reviews the literature bearing on this subject, which reveals wide differences of opinion as regards the contagiousness of pneumonia. No special etiological factors accounting for this apparent contagiousness could be found in the above group.

The Ophthalmo-Tuberculin Diagnostic Test.—EDWIN R BALDWIN (*Jour. Amer. Med. Assoc.*, 1907, xlix, 1669). The early diagnosis of tuberculosis is so important that every apparent improvement in methods is worthy of a careful trial. The use of tuberculin, both hypodermically and as a skin vaccine has been widely practised. Professor Calmette has recently advised the introduction of weak tuberculin solutions (1 per cent.) into the eye; a marked conjunctival hyperemia results in infected individuals. Baldwin has used this method, slightly modified, and reports on the reaction in 137 cases. His conclusions are that it is a little premature to express an opinion as to the value of this test in diagnosis when compared to the subcutaneous one However, one can see a close similarity in the results with those obtained in the fever test, which, also, when given to healthy and suspected individuals, has shown a high percentage of positive reactions. The prompt positive reaction in the eye adds to the suspicion when symptoms of tuberculosis are present. No value is to be placed on a positive reaction in the absence of symptoms of tuberculosis. Baldwin hopes that, ultimately, carefully controlled results at the postmortem table will give us the real limitations of these methods of diagnosis. Certainly, the simplicity of the method (as the dose can now be obtained in little capillary tubes such as are used for glycerinized vaccine) should recommend its use and the careful determination of its value.

A later report along this same line, with the results of the ophthalmic reaction in 242 cases, is given by Smithies and Walker (*Jour. Amer. Med. Assoc.*, 1908, l, 259), who conclude that this test is of undoubted service in the diagnosis of tuberculosis. In no cases in which its worth could be tested clinically by the finding of tubercle bacilli did they fail to obtain decided ocular manifestations following the instillation

of tuberculin. This reaction did not follow when instillations were made in 126 individuals affected with diseases other than tuberculosis. It was not obtained in 74 apparently healthy adults. Care in the technique of its administration is very necessary for the success of the reaction. When the ophthalmic reaction is positive a careful complete examination of the suspected focus must be made before passing final judgment. All suspicious cases which fail to respond to one instillation should be reinstilled from two to five times and careful examinations made. None of the reactions (skin, subcutaneous, or ophthalmological) take the place of a thorough examination of the patient. They are, however, all confirmatory. Properly administered, the ophthalmic reaction is quite as valuable to the general practitioner as any of the others, and its convenience and rapidity of action certainly commend it.

Compensatory Venous Congestion.—W. J. CALVERT (*Johns Hopkins Hospital Bulletin*, 1907, xviii, 447). In comparing the compensation of mitral and tricuspid insufficiency it has been noted that the liver and the peripheral vessels play the same role in compensation of the tricuspid valve as the right ventricle in compensating mitral insufficiency. Solomon found that the normal liver under high pressure holds its volume of water, most of which is expelled when the pressure is removed. This sponge-like activity of the liver may, with continued pressure, be destroyed, and so the degree of activity of the liver in compensating the heart lesions may be interfered with in the different forms of cirrhosis, etc. In order to bring out more clearly this role of venous congestion, Calvert studied more especially cases of pericarditis with effusion which, by pressure on the vena cava in the pericardium, produced most striking effects on the venous circulation. When high, this pericardial pressure causes the veins to collapse. When low, they are open. The only pressure that could keep them open is the venous pressure due to congestion. This must then compensate the pressure of the pericardial fluid on the vena cava, and this compensation must continue or the veins will be collapsed and prevent the blood from entering the heart. As the maximum venous pressure can be produced in pericarditis with effusion, and is no greater in tricuspid lesions, it must follow that this can be compensated for in the same degree as in pericarditis with effusion. The activity of the auricle must be taken into account, but if inactive and dilated, as suggested by Franke, it simply adds that much blood to the venous congestion. The congestion including the liver and right auricle in tricuspid insufficiency must be likened to the left auricle, pulmonary congestion, and right ventricle in mitral insufficiency. The right ventricle in tricuspid lesions plays the same role as the left ventricle in mitral lesions. Calvert concludes that on account of the importance of venous congestion in compensating pericardial and pleural effusions, pneumothorax, and tricuspid lesions, the name "compensatory venous congestion" should be used as a term which more accurately describes the function of congestion than the term chronic passive congestion, which was adopted at a time when the role of congestion had probably not been fully considered.

Additional Observations on Microbic Cyanosis—G. A. GIBSON (*Quar. Med. Jour.*, 1907, i, 29). A few years ago Stokvis described for the first time the occurrence of cyanosis as the result of intestinal troubles. He believed the cyanotic appearance was produced by methemoglobin, but did not discover the manner in which the blood changes were produced. In his case there was clubbing of the fingers, deep cyanosis, and considerable albuminuria. At autopsy the lesions were those of ulcerative enteritis and parenchymatous nephritis. Since then there have been a few reports of such cases by different authors, in all of which the connecting link between the intestinal troubles and the cyanosis was established; yet the views as to the exact relation between the two conditions have varied. Gibson's case was that of a lady, aged thirty-six years, who had suffered for some years with weakness, headache, giddiness, and fainting. The skin and mucous membrane during these years had gradually become very cyanotic. The blood was as follows: Red blood cells, 3,200,000; hemoglobin, 48 per cent.; color index, 0.75; leukocytes, 7400. There was some poikilocytosis, but no nucleated reds or chromatophilia. Differential count showed 65 per cent. polymorphonuclears, 28 per cent. small mononuclears, 5 per cent. large mononuclears, and 2 per cent. eosinophiles. There was much intestinal irritation and gastric disturbance. The urine contained no albumin. Examination of the blood showed the presence of methemoglobin and a considerable amount of nitrites. The saliva also showed more nitrites than normal. The feces did not contain methemoglobin, and possessed no power of converting normal ox blood into methemoglobin. There were present, however, some nitrites. On the supposition that the formation of these nitrites might be hematogenous and due to bacterial agency, careful bacteriological examination of the blood was made with the isolation of an organism resembling the colon bacillus. The original source of this condition was traced to the bowels and the patient treated accordingly by means of intestinal antisepsis, with marked alleviation of her symptoms; when seen some time later the cyanosis had entirely cleared and the blood changes approached normal. There was no methemoglobin in the spectroscopic examination of the blood, and no organisms were cultivated from it. Toxic processes having their origin in some local infection with the colon bacillus are, of course, widely known, yet the idea that changes such as these might be brought about by their final entrance into the blood is entirely new. Gibson feels convinced that in the above-described condition we are dealing with a hitherto undescribed but perfectly definite form of disease. The colon bacillus may give rise to three stages of infection, in the first of which the intestinal symptoms are prominent as enteritis, diarrhœa, headache, and depression; in the second, the changes are referable to the formation of the nitrites which, by their absorption into the blood, give rise to methemoglobin and resulting cyanosis; in the third, the entrance of the bacilli into the blood and their multiplication there results in the development of the condition described above. As regards treatment, this should, of course, be intestinal antisepsis, either medically by drugs or, if justified, surgically by means of a colostomy and irrigation.

Multiple Telangiectases.—This condition is the subject of two very interesting papers by OSLER, the first of which is on "Multiple Hereditary Telangiectases with Recurring Hemorrhages" (*Quarterly Medical Journal*, 1907, i, 53). The author observers that telangiectases may be seen under the following conditions: (1) On the cheeks, nose, and ears in persons who are exposed to the weather and in heavy drinkers. They may appear in very young persons. They are commonly seen on the skin of the thorax along the line of attachment of the diaphragm. (2) Small pink spots often pin point in size. (3) Small nodular forms which may be congenital. (4) The spider form with its interesting association with cirrhosis of the liver. (5) The mat form. (6) The generalized acquired telangiectases (reported below); and lastly, (7) the multiple hereditary form with recurring hemorrhages. Illustrative of this latter group, Osler refers to the history of two brothers who had numerous telangiectases of the skin and mucous membranes (*Johns Hopkins Hosp. Bull.*, xii, 333), and who from childhood had bleeding from the nose and some of the spots. Seven members of their family had been subject to them. In one case at autopsy telangiectases were found in the mucous membranes of the stomach. Another case, reported in detail and illustrated, is that of a doctor, aged fifty-three, who was extremely anemic when first seen and had numerous telangiectases over the face, ears, and lips. He had been a bleeder since his tenth year. There was a family history of bleeding and of the presence in some members of the telangiectases. This patient improved greatly under the use of calcium lactate, 60 grains daily. His coagulation time had been reduced from six to seven minutes to one and a half minutes. In this condition the telangiectases are of three kinds—the pin point, the spider form, which is the commonest, and the nodular variety. These are well seen in the accompanying illustrations. Osler has brought together the history of eight families affected in this same manner, in many of which the disease was serious on account of the severe and frequent bleedings. Marked anemia and even death have been the outcome.

As regards treatment, the careful application of the cautery at the outset of the disease, especially to the stellate veins of the nostrils, may prevent hemorrhages. This, while producing severe hemorrhage in one case, had a beneficial result ultimately, as no severe epistaxis occurred for many months. Calcium lactate seems to help some cases very markedly.

The second article by Osler is the report of a case which falls undegroup 6 as reported above, that is, "Telangiectasis Circumscripta Unir versalis" (*Johns Hopkins Hosp. Bull.*, 1907, xviii, 401). This excessively rare form of the disease, of which only some 15 to 20 cases are on record, occurred in a man, aged thirty-nine years, of a markedly neurotic temperament. The family history was negative. His general health had been only fair, and the purplish mottling of the skin had been noted during the past ten years. There was no definite history of continued bleeding. The present attacks of severe pain and associated prostration led to his admission to the hospital for treatment. During his first attack of pain a large amount of bloody urine was passed. Physical examination was practically negative excepting for the appearance of the skin. The face showed a few spots like acne rosacea, but over the trunks and extremities were numerous dark red spots looking like a fresh purpura. They were thickly set over the chest and back,

on the flexor surfaces of the forearm and inner aspects of the arm. The spots varied in size from 2 to 6 mm. in diameter and often coalesced. They were altered in color to a vivid red by friction. The hands and feet were of a deep purple color, the fingers cyanotic, and looked like the picture of Raynaud's disease. Factitious urticaria could be readily produced. (This and the skin conditions as described above are well shown in plates.) Osler notes that this is an acquired and not a congenital form. The capillaries and not the small venules are involved, that is, there is a prominent dilatation of the capillaries in localized areas. The condition of the hands and feet suggests the local asphyxia of Raynaud's disease. There was little or no change in the patient's condition a year after first seeing him. The dermatographia was always most marked and very striking. The reeurring attacks of colic, for which no cause could be found, may have been associated with a gastro-intestinal urticaria, such as is responsible for the colic in Henoch's purpura. The hematuria may be a form of so-called renal epistaxis, such as is met with sometimes in Raynaud's disease. As regards treatment, modified Weir Mitchell rest cure, with symptomatic measures were of some benefit in this case.

SURGERY.

UNDER THE CHARGE OF

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Mechanical Obstruction by Torsion of the Whole of the Small Intestine and its Mesentery.—DELBET (*Arch. gén. de Chir.*, 1907, i, 343) reports a case in which, seven months before, the patient had had the appendix removed. The present attack began suddenly with severe pain throughout the whole abdomen and bilious vomiting, and these symptoms were present on his admission to the hospital. The abdomen was moderately distended. The diagnosis was made of occlusion by an adhesion or a band high in the small intestine. A median laparotomy below the umbilicus was performed forty-four hours after the beginning of the attack. Some brownish fluid escaped, and there was discovered, to the inner side of the cecum, a tense band, under which two loops of intestine escaped. Total volvulus of the small intestine was diagnosticated. This was uniformly distended and bluish in color and its mesentery brownish and thickened. The large intestine was contracted and normal in color. Evisceration and detorsion of the intestinal mass was performed and two intestinal loops released from under some old adhesions. Drainage

was employed. Recovery ensued. Early operation probably saved the patient. In torsion of the whole of the intestine the two points compressed are at the extremities of the small intestine. There is considerable distention, but it varies with the resistance of the wall. The abdominal wall is always very tense and markedly tympanitic, to the extent of masking the liver dulness. There is fluid in the peritoneal cavity resembling that of a strangulation. Bilious vomiting is rarely absent and is usually abundant. While the diagnosis is usually easy at operation in a partial volvulus, it is not so in a total volvulus. Only exceptionally can one see the mesentery twisted into a cord. Delbet insists on the following signs of recognition: The small intestine is distended and congested in its whole extent; the cecum is empty; the last part of the small intestine is engaged behind a prominent band, under which issues another distended loop; this loop is not fixed against the cecum, as it would be if it were part of a retroperitoneal hernia; finally, there exist two bands formed by dragging of the parietal peritoneum. One is directed upward toward the left kidney, the other descends toward the iliac vessels.

A Case of Radical Mastoid Operation, with Subsequent Septic Infection and Rupture of the Lateral Sinus.—RENSHAW (*Brit. Med. Jour.*, 1907, ii, 1208) operated on a young man who had had purulent otorrhœa of the left side for five years. On commencing to remove the bone the sinus was almost immediately exposed, lying only a little over one-eighth of an inch behind the posterior wall of the meatus. The sinus wall was apparently uninjured. The antrum and attic being freely exposed, the bone was everywhere found extremely sclerosed, with patches of caries After removal of all diseased tissue and arrest of hemorrhage, and treating the cartilaginous meatus by the Panse method, the cavity was packed and the superficial wound sutured. The packing was removed on the third day and daily after that. On the morning of the seventh day the temperature rose to 103.2°, but at 6 P.M. it was normal. On the following day there was a similar rise, which was repeated on the next day. The wound was then reopened to ascertain if a septic thrombus had formed in the lateral sinus. Before this could he done there was a sharp hemorrhage from the ear. On opening the original incision, the cavity was found full of clot. On carefully removing it there was a sudden gush of blood, evidently from the spot in the sinus exposed at the first operation. This opening was plugged with iodoform gauze and a rubber tube was passed from the meatus into the deeper part of the antrotympanic cavity, and the wound dressed. On removal of the packing two days later a severe hemorrhage followed. Fresh packing was inserted. The temperature continued to rise and 10 c.c. of antistreptococcic serum was injected. The temperature immediately improved, but remained irregular. Five days after the second operation the dressing was removed, but the gauze in the sinus aperture was undisturbed. This was removed piecemeal at the subsequent dressings. A cure gradually followed.

The Treatment of Fractures of the Fingers.—JOTTOWITZ (*Zentrlbl. für Chir.*, 1907, xxxiv, 1313) says that in his experience the deformity in these fractures was almost always of such a character that the fragments made

an angle opening on the extensor side of the fingers. He has repeatedly seen old healed fractures which retained this deformity, and in these the closure of the fist is much disturbed. A more or less sharp bony projection is found at the seat of fracture, which is prominent on the flexor side of the finger. The flexor tendons thus become stretched over this prominence, producing flexion of the middle joint and to a less extent of the terminal joint of the finger. The result of the faulty position of the distal fragment is to produce extension at the metacarpophalangeal joint so that when a fist is made the fractured finger remains in a posterior position. Good results depend first upon complete reduction of the deformity. The finger should not be splinted in complete extension, especially if the fracture is located near the base of the finger. A flexed position of the whole finger is much better, since it best corrects or overcorrects the usual deformity. This was accomplished by placing an ordinary roller bandage in the palm of the hand and flexing the fingers over it, only the terminal phalanx remaining extended. One or the other neighboring finger may be included in the dressing to prevent lateral displacement of the fragments.

The Preliminary and After-treatment for Laparotomies.—HIPPEL (*Zntrbl. für Chir.*, 1907, xxxiv, 1345) says that Vogel recently reported on the excellent results which he obtained from the subcutaneous use of physostigmine for the stimulation of peristalsis in the after treatment of laparotomies. By the early accomplishment of this object he considered that we had the surest means of avoiding adhesions. Purgatives cannot be employed for obvious reasons. He has not seen postoperative ileus since he has been employing physostigmine in this way. With a similar experience in 60 cases, Hippel is convinced of the value of this treatment. He departs somewhat from Vogel's method. Immediately after the operation he injects 1 mg. of physostigmine, and repeats it every three hours until the bowel action sets in, which is shown by a feeling of compression in the abdomen. Then a rectal tube is introduced and left in for about an hour, and from this the gas escapes. Generally from two to four doses are required, and these cause no evil effect. On the day after operation a glycerin enema will produce a movement of the bowels, usually without pain. Besides tending to prevent adhesions by preventing distention, it decreases the number of ventral hernias, and there is less danger due to elevation of the diaphragm from gaseous formation with its injurious effects upon the heart and lungs. In addition, from the earlier intestinal action, nourishment is given earlier and in larger quantities and the patient gets out of bed earlier.

The Transverse Incision for Nephrotomy.—ZONDEK (*Zntrbl. für Chir.*, 1907, xxxiv, 1369) says that the neighboring branches of the renal artery run in a radiating direction from the hilum to the lateral convex surface of the kidney. An incision in the same direction can fall between two neighboring branches and the damage to the tissue be very slight. This will be particularly limited to the unavoidable division of the peripheral branches. With the kidney freely exposed the incision can certainly not avoid all the large branches, and the danger will increase as the incision approaches the hilum, from which the branches spread out. Even if, unfortunately, two neighboring branches should be divided, the

damage to the parenchyma would then not be very marked and the disturbance of the blood supply would be slight. The incision must be a radiating one for all parts of the dorsal surface of the kidney, whether in the middle of the kidney or near the poles. The depth of the incision into the parenchyma, however, determines the damage done either by the transverse or the longitudinal incision. In the region of the cortex little damage is done whether the transverse or the longitudinal incision is employed. The large calibered vessels are located in the depth of the kidney.

The Treatment of Acute Suppurative Inflammation by Passive Congestion.—WREDE (*Archiv f. klin. Chir.*, 1907, lxxxiv, 733) says that the same material may yield different results under different conditions, and that these results may be viewed from different standpoints. He says that, theoretically and practically, the effects of suction, as by cupping, and those of passive congestion by the use of the bandage around the limb are not the same. Cupping in some inflammatory conditions works better than the bandage. The question of incision in the inflamed area has often been ignored. Croce incised even when pus was not present. Many others have used incision in connection with the Bier method. Wrede considers that the good results, when both were employed, were due to the incision and not to the passive congestion. The secondary lymphangitis, severe inflammation, and suppuration, which cannot be avoided by the passive congestion, have been looked upon as beneficial. Wrede cannot see its advantage, and is strongly in favor of the older method of treatment. He does not dispute the good effect of passive congestion for many cases, but he differs from Bier in estimating the value of this method as contrasted with incision. There are conditions, at times, in severe cases, when the increased congestion and increased inflammation produce evil results.

Experimental Studies on the Pathology and Surgery of the Heart.—HAECKER (*Archiv f. klin. Chir.*, 1907, lxxxiv, 1035) lays special stress on the value of Sauerbruch's apparatus for the performance of intrathoracic operations, particularly for those on the heart. The tranquility from absence of pneumothorax, and impaired breathing, facilitates an operation upon such a restless organ as the heart. The anxiety of avoiding a pleural opening, and, therefore, pneumothorax, is overcome, as it matters little whether such an opening is present or not. Generally, the intercostal incision is to be recommended because it can be made quickly without loss of blood, and offers a free opening and good view. A developing pneumothorax, by collapse of the lung, lessens the hemorrhage from a heart wound, and at the same time the heart wall is relaxed. If it continues long it impairs the heart's strength. Great advantage of these facts can be taken in the Sauerbruch apparatus for lessening hemorrhage and introducing sutures through the relaxed heart wall. By avoiding pneumothorax the danger of infecting the pleural cavity is considerably reduced. Bleeding occurs during systole. In introducing the sutures the heart can be grasped in such a way that the veins leading into it can be compressed. The heart being turned forward the hemorrhage is also considerably diminished by the resulting kinking of the vessels. A continuous suture of median-sized catgut or

of silk is recommended, and it should include the epicardium and myocardium. The first end should be left long as a retractor. After ligature of the superior cava, dogs died in from twelve to fourteen hours with gradual diminution of the blood pressure. They withstood well, for ten minutes, simultaneous clamping of the two body veins. Thrombosis of the veins during this period was not observed. It is possible, by clamping the superior and inferior cavæ and the great vein of the heart, to perform short, bloodless operations on the heart. In this manner, one of the cavities of the heart was successfully opened extensively, a good view of the inside obtained, and palpation carried out. Penetration of air into the opened heart cavity, air emboli in the lung or brain vessels, were not observed. Small, foreign bodies, finding their way into the heart, were immediately carried by the blood current, with the exception of needles, which remained in the heart. Healing of a foreign body in the heart is possible. If it produces disturbances the heart cavity should be opened, bloodlessly, and the body removed. Generally, the effect of its presence was to produce an irregularity of the pulse, which quickly disappeared. By the employment of the bloodless method, pieces of the heart wall were successfully removed. It was observed several times that, apparently, a wound in one part of the heart wall (left auriculoventricular septum?) caused the heart to stop immediately. After exposing the heart freely enough, deficiencies in the valves and other anatomical changes could easily be produced in animals. Haecker would go further than to operate on the heart merely for wounds in its walls. He considers it possible to remove foreign bodies when they give trouble, even to the extent of opening the heart cavity. He believes it will be possible, in aneurysms of the heart as of the aorta, rebellious to every other treatment, to expose the aneurysm for surgical treatment.

A Contribution to our Knowledge of Typical Dislocation; Fracture of the Intercarpal Joints.—Schoch (*Deut. Ztschr. f. Chir.*, 1907, cxi, 53) says that the combination of anterior dislocation of the semilunar bone with fracture of the scaphoid and anterior displacement of its proximal fragment, first described by de Quervain, has been demonstrated by later experience to be a typical injury. Next to the isolated dislocation of the semilunar and fracture of the scaphoid it is the most frequent carpal injury. Schoch considers that the most simple name for it is "typical intercarpal dislocation fracture." It is caused by severe violence, in the majority of cases by a fall from a height on the outstretched arm, in which the hand is either in moderate dorsal flexion and strikes first on the small heads of the metacarpal bones, or it is in hyperflexion with the ball of the hand receiving the force of the fall, or, finally, it is in volar flexion, and the force is received by the dorsum of the hand. In explaining the mechanism one must take into consideration the fact that the distal portion of the scaphoid and to a certain extent the cuneiform with the pisiform are in relation with the distal portion of the carpus, while the semilunar and proximal portion of the scaphoid, alone, bring the radius in relation with the rest of the carpus. The chief symptoms of this injury are: swelling of the wrist joint, failure of active movements of the hand, and great pain upon passive movements. The carpus is also thickened, broadened, and shortened.

Beyond the radial border, anteriorly, is found bony resistance; the finger movements are disturbed, and, finally, we have symptoms of pressure on the median nerve. These symptoms and the skiagraph make the diagnosis. The prognosis is always to be regarded as serious. Only when the reduction is successful can an approximately complete return of function be hoped for. If operative treatment is required, movements of the hand will be disturbed while the finger movements and the strength almost never return to the normal, so that at least from one to three years will be necessary before the patient will be able to use the hand in heavy work. Without operation the hand will be in a much worse condition, and in unfavorable cases or from inadequate retention the wrist may become almost completely ankylosed. The treatment for the great majority of cases is as follows: First non-operative, then operative reduction. When these are not successful, according to circumstances, the proximal fragment should be extracted and the semilunar replaced, or the latter with the scaphoid should be extirpated, or, finally, the distal fragment of the scaphoid fragment should be extirpated. The after-treatment consists chiefly in vigorous and long-continued systematic movements, and after about one to three months the patient should resume work, at least in part.

Treatment of Facial Neuralgia.—DEPAGE (*Jour. de chir. et ann. de la soc. Belge de. chir.*, 1907, vii, 470), in discussing this subject before the society, says that when the neuralgia cannot be cured by medical treatment sufficiently prolonged, it is proper to operate. Partial excisions of the peripheral branches of the trigeminal nerve are generally followed by recurrence, sooner or later. Excision of the Gasserian ganglion is an operation, of which, under proper technique, the results are very encouraging. The cures which it produces are absolutely permanent. Experimental researches have established that sudden and violent tearing away of the large divisions of the nerve at the base of the skull, permanently interrupts the sensory paths of the trigeminal nerve. The favorable results obtained in man make this operation more desirable than excision of the Gasserian ganglion, the execution of which is more difficult. The future will decide whether the newer operation will give as certain results.

Primitive Renal Lithiasis.—SOURDILLE (*Archiv. gén. de Chir.*, 1907, 1, 418) says that in renal lithiasis the diseased kidney is generally polyuric as compared with its fellow. When this relation is reversed the diseased kidney is totally insufficient and functionally incapacitated. On the other hand, if the total quantity of urine for twenty-four hours is distinctly above the normal, while the diseased kidney is hardly functionating, it is better to be suspicious. The sound kidney will be likely to give way because a polyuric kidney is a diseased kidney—a forced kidney. The quantity of urea secreted by the calculous kidney is generally very appreciable, and the average relation between sound and diseased kidney is as 1 to 2. It is the same with the chlorides. The difference in the secretion of the two kidneys is often insignificant. When the two secrete the same quantity of urine there is less urea and phosphates from the diseased kidney, and the freezing point of the urine is lowered. When the kidney which secretes the more urine pre-

sents at the same time a higher freezing point and more urea and phosphates per liter, this kidney should be considered the better of the two, not only from the functional point of view but from the anatomical also (Albarran). The elimination of methylene blue is often much retarded and less intense in renal lithiasis, and it is absolutely insufficient as a means of judging the condition of the kidneys in this affection. Albarran showed, experimentally, that the function of the diseased kidney is much more constant than that of the healthy one. The difference between the two kidneys is exaggerated by the variations in function of the healthy kidney. From what precedes it it is evident that renal lithiasis has a double localization. If there is not double lithiasis there is at least double nephritis, and beyond the local lesions due to the stone the one kidney is as badly off as the other. Nephrectomy should be done only in case of absolute necessity.

The skiagraph is to renal calculus what the cystoscope is to tumors of the bladder. The chemical composition of the stone is of great importance. Oxalic calculi are always visible by the skiagraph. Then come the phosphatic and those of alkaline carbonates. Uric acid calculi do not give a shadow. Those cases of uric acid calculi, published as giving skiagraphic shadows, had an appreciable quantity of phosphates or oxalates. The size of the stone and of the patient also affect the distinctness of the skiagraph: positive results affirm the diagnosis. As for the negative results, if the lithiasis is aseptic, they do not exclude the diagnosis of uric acid calculi; but if the urine is septic they eliminate the diagnosis of large renal calculi.

Chronic Adhesive Appendicitis.—HABERER (*Mitt. a. d. Grenzgeb. d. Med. u. Chir.*, 1907, xviii, 169) says that primary chronic appendicitis does not give a well-defined clinical picture. The patients complain of long-continued disturbances in some region of the abdomen, frequently with a changing location. Observation for some time is always necessary in order, finally, to make the diagnosis with any certainty. The objective symptoms are also very vague. A changing seat of tenderness is observed, and fever is sometimes mentioned. Generally, according to other writers, there is chronic constipation which is not rarely associated with the signs of membraneous colitis. Cecal distention is said to be present in almost all the cases, and often by repeated examination the appendix can be palpated. From a study of 7 cases, Haberer says that the vague findings were in marked contrast to the complaints of the patients. In no case was there anything pathological in the region of the cecum, and in none was tenderness at McBurney's point made out. Symptoms permitting the diagnosis of a nervous affection in the region of the appendix were found in no case. Tuberculosis could not be established in any case, and in not one was there fever during the stay in the hospital. In the two women, among his cases, disease of the genital organs could be excluded with certainty. The diagnosis, supported chiefly on the statements of the patients, could only be made by exclusion. Haberer considers that it is not sufficiently emphasized that an appendicitis which runs a course not merely free of attacks, but is entirely symptomless, can lead to changes in the appendix and extensively in the peritoneum. This can develop the picture of an intestinal stenosis with severe constitutional disturbance and advanced emaciation.

THERAPEUTICS.

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Colloidal Metals in Infections and Especially in Pneumonia.—ROBIN (*Gaz. méd. de Paris*, xiii, 7, 3) reports 53 instances of pneumonia treated by these substances with a mortality of 6 patients; in 63 per cent. of the patients defervescence took place on the eighth day. The results in bronchopneumonia were less favorable, 6 deaths in 13 patients having been reported. The metallic ferments were administered deeply under the skin in doses of 2½ drams or intravenously in half this amount. The metal employed seemed to make no difference in the result. The treatment should be begun on the fourth day and should be repeated every two days. Other infections have been treated by the same means, the injections consisting of 75 minims of colloidal silver, palladium, or platinum, and good results have followed the treatment in instances of enteric fever, epidemic influenza, severe jaundice, acute articular rheumatism, scarlatina, and pulmonary tuberculosis.

Bacterial Vaccines in Therapeutics.—ROSS (*Jour. Amer. Med. Assoc.*, 1907, xlix, 1245) states that he is firm in the belief that proper inoculation with appropriate bacterial vaccines is a powerful expedient for the cure or control of many diseases due to microörganisms. He is of the opinion that, though estimation of the opsonic index is often unnecessary, still such investigation has been and still is of great service in the determination of proper dosage and appropriate time for inoculation and reinoculation; that the estimation of the opsonic index, according to our present methods, is mathematically accurate few would claim, but that it is sufficiently so to serve as a useful guide in vaccine therapy can hardly be denied.

The Absorption of Digitalis and Glyceryl Nitrate.—ZEMP (*Jour. Amer. Med. Assoc.*, 1907, xlix, 16, 1349) gives the following practical deductions from a study of the absorption of these important and much-used drugs: Digitalis cannot be relied upon in emergency when quick heart stimulation is necessary. Here we should employ it in connection with alcohol and ammonia, for when the action of the diffusible stimulants is beginning to wane the digitalis will be taking up the work and will continue it for some time. Dropsical patients who have taken large doses of digitalis for some time should be tapped with care, for the sudden withdrawal of the fluid may cause absorption of enough of the drug to poison the

patient. Digitalis should not be given in instances of acute gastric disturbance, since the drug is irritant to mucous membranes. Here the therapeutic effect of the drug may be obtained by applying a poultice made from the leaves to the loins. Most digitalis preparations are precipitated into the tissues when given hypodermatically, which accounts to some extent for the slowness of the drug's action when given in this way. Glyceryl nitrate may be used when a quick effect is desired to relieve pain due to muscular spasm, as in angina pectoris. When given for its effect in relaxing arterial tension it should be administered at short intervals. It is useless to give this drug three times daily; nor should it be combined with digitalis with the idea of overcoming the contraction of the arterioles caused by the latter, for the effect of the one is brief while that of the other is prolonged. The counteraction may, however, be obtained by giving the glyceryl nitrate separately and at proper intervals.

Tuberculin Injections in Chronic Joint Disease.—RIDLON (*Amer. Jour. Orthop. Surg.*, 1907, v, 14) concludes a paper on this subject as follows: A low tuberculo-opsonic index with local joint symptoms may be accepted as evidence of joint tuberculosis, but a practically normal tuberculo-opsonic index, together with local joint symptoms, neither proves nor disproves the existence of articular tuberculosis. When the diagnosis of joint tuberculosis has been made, a high tuberculo-opsonic index should be maintained, if possible. With a high tuberculo-opsonic index an operation for the removal of all or part of the local disease may be undertaken; not so with a low index. If the use of the diseased joint lowers the index the joint must be protected; if not, the joint may be used; if use raises the index it should be insisted upon. General elevation of temperature after a tuberculin injection indicates too large a dose. A persistent lowering of the index during injection treatment indicates that the injection has been given at the wrong time, during the so-called negative phase. While realizing that this form of treatment has been employed too short a time to warrant any very definite conclusions as to its efficacy, Ridlon states that he believes that the tuberculin injection treatment, guided by the tuberculo-opsonic index is a promising step in advance in the treatment of articular tuberculosis.

Antineoplastic Serum in Cancer.—DOYEN (*Rev. de therap.*, 1907, lxxiv, 469) reports several instances of carcinoma of various parts of the digestive system which have been treated by his serum and draws the following conclusions: Observation shows that the treatment is absolutely harmless, and not only is it able to remove the early symptoms of gastric cancer, but also, in certain instances, the manifestations of pyloric stenosis. Similar results have been observed in a certain number of instances of cancer of the small intestine and colon. To get the greatest benefit from the treatment it should be employed early in the disease and before the patient's vital forces have become vitiated. Results appear satisfactory in three patients. These have been followed for five, four, and three and one-half years, respectively. The author states that he has seen a number of other patients who had been advised

to have an artificial anus made on account of malignant rectal stricture, but who, after injections of the anticancer vaccine, were able to pass formed stools of the size of the thumb. He considers diabetes no contra-indication to the treatment, which is essentially that which he advocated in 1901. He, however, no longer employs the serum of immunized horses.

The Treatment of Enteric Fever with Specific Sera Filtrates and Residues.—RICHARDSON (*Boston Med. and Surg. Jour.*, 1907, clvii, 449) summarizes a study of the specific therapy of 130 enteric-fever patients thus: (1) Specific therapy, confined to the original disease, seems to increase the tendency to relapse. (2) By inoculation with Vaughan's non-toxic residue, continued into convalescence, this tendency can be largely eliminated. If relapses can be prevented, then it almost certainly follows that mild enteric infections can be aborted. (3) To get the best results patients must be seen as early as possible in the infection, but (4) an early diagnosis is often impossible, and consequently specific therapy is heavily handicapped. (5) Antityphoid serum is no more effective than filtrates and residues, and is much more expensive. (6) Typhoid filtrates may exert a powerful effect upon the course of the disease, their use being followed in many instances by chills, or rise in temperature, pulse, and respiration, and a general improvement in condition. The nature of these reactions is unknown, but possibly further study, especially of the opsonic index, in connection with these reactions may throw light upon the subject. (7) The non-toxic residue of the typhoid bacillus, as prepared by Vaughan, seems to lengthen the typhoid process, but to render it milder, and is apparently very effective in preventing relapses.

Antidiphtheritic Serum in General Therapeutics.—MONGOUR (*Jour. de méd. de Bordeaux*, xxxvii, 26, 405) has treated 15 patients suffering from various infections, enteric fever, scarlatina, septicemia, cholecystitis, etc., exclusively with Roux's antidiphtheritic serum, and in all has arrived at most excellent results. No by-effects were observed after the serum injections other than erythemas and arthralgias. In all the patients the betterment in both local and general symptoms was marked and rapid. The dosage varied in the different patients, and repetitions were sometimes necessary. While the relation between the serum and the effect produced was less striking than is the case in diphtheria, nevertheless the effect followed the serum injections with such rapidity as to leave no doubt as to the relation between them. The action of the serum may perhaps be attributable to the hyperleukocytosis which it causes, and the augmentation of the resistance of the organism which accompanies this phenomenon.

The Serum Treatment of Exophthalmic Goitre.—BULKELEY (*Boston Med. and Surg. Journ.*, 1907, clvii, 626) reviews the reported instances of Graves' disease which have received serum treatment, and concludes that we may accept the statement that the palliative action of the serum seems certain, and cure may be possible. Improvement usually begins within seven days; if there is no improvement in three or four weeks

the chances are against ultimate benefit. Tachycardia, tremor, and precordial distress show the greatest improvement. Patients without marked goitre, with slight tremor and exophthalmos yield most readily. The weight usually increases, but continued use of the serum may be necessary. A contrast of the different sera offers little of value. The patients treated by Rogers and Beebe by their antitoxin are not included in the review. Of drugs Bulkeley considers quinine hydrobromide the most efficient. If its administration causes a bromic acne, quinine valerinate may be employed as a substitute, and it appears to be nearly as efficacious.

A Polyvalent Antidysenteric Serum.—COYNE and AUCHE (*Journal de médecine de Bordeaux*, 1907, xxxvii, 705) state that the groups of dysentery bacilli have certain differences, but it is not yet possible to differentiate them with accuracy; for this reason they have thought that an immune serum prepared exclusively from Shiga's bacillus would not have the same action against bacilli of Flexner's group as against those of Shiga, and that the use of Flexner's bacillus in preparing the serum ought not to diminish its curative or preventive power. This polyvalent serum has showed a distinct curative and preventive action in rabbits, and it has given indisputably good results in the instances of dysentery in infants in which it has been employed.

Serum Therapy in Enteric Fever.—CHANTEMESSE (*Klin. therap. Woch.*, 1907, xiv, 1055) has demonstrated that antityphoid serum raises the opsonic power of the blood in typhoid fever, and is very potent as a therapeutic measure. It has been hoped that the administration of the serum would render the employment of cold baths unnecessary, but these latter are very useful in combating the reaction brought about by the rapid destruction of the typhoid bacilli in the organism due to the serum injections. Hence, in his opinion, the treatment of choice in enteric fever seems to be the employment of the antiserum in connection with the application of cold or cool baths.

Sodium Bibromomercurate in Syphilis.—LEREDDE (*Journal de médecine de Paris*, 1907, xix, 418) concludes that this salt of mercury possesses certain advantages over the other mercurial preparations which are employed in the hypodermatic treatment of syphilis. It is less paniful to the tissues, the dosage being equal, than those which have been proved by trying both agents upon the same patients, and its therapeutic activity is quite as great as other mercurials which are applicable to hypodermatic administration. Its disadvantage—a minor one—is that it must be injected through an iridoplatinum needle.

The Treatment of Hemorrhages in Hemophilia, Purpura, and Allied Conditions.—WEIL (*Paris letter, Boston Medical and Surgical Journal*, 1907, clvii, 683) has found that the addition of a little human serum to blood taken from sufferers from hemophilia, causes the abnormalities in the coagulability of the blood to disappear entirely, and has concluded from clinical observations that injections of blood serum are an effectual means, even more so than the administration of the calcium salts,

of checking hemorrhage by means of increasing the coagulability of the blood. The treatment consists in injecting 5 drams of serum, preferably human, but that of the horse or rabbit will do, either intravenously or subcutaneously. Cattle serum causes accidents and is debarred. The effect of the injection begins after twelve to twenty-four hours and lasts from one to three months. The method is applicable as a preventive before operation, at long intervals to anticipate hemorrhagic symptoms, and as a curative agent during the hemorrhagic stage of any of the affections mentioned.

PEDIATRICS.

UNDER THE CHARGE OF

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Nephritis in Infants.—Albumin has been found in the urine of healthy infants during the first few days and sometimes weeks by many observers, and the same is true of hyaline, epithelial, and granular casts. G. CARPENTER (*Brit. Jour. of Children's Diseases*, 1907, iv, 421), on the other hand, found the urine of newly born infants often free from albumin and tubecasts. In the course of different diseases, particularly pulmonary and gastro-intestinal affections, albumin and casts have been reported in a large percentage of cases, but Carpenter, who has examined the urine of 62 patients coming under his observation for a variety of ailments, found albumin in 2 only. In one, a child of one month, the mother's milk was failing, in the other, a child aged six months, pus cells and desquamated bladder epithelium in the urine accounted for the albumin. The infants examined by him were both breast-fed and bottle-fed. He finds that albuminuria is rare in the œdema of infantile gastro-enteritis. In several instances, in which albuminuria was present with or without tube-casts, and autopsies were performed, the kidneys looked healthy and the microscope confirmed the macroscopic appearance. There was renal inadequacy, but no nephritis. Renal incompetency with a scant secretion of urine is common in bronchopneumonia. Dropsy in such cases is probably due to retention of chlorides. Experiments have confirmed this theory, as chloride of sodium always diminishes the urine and increases the body-weight, its omission increases the urine and diminishes the weight. If œdema exists without albuminuria and casts, it is improbable that the kidneys are diseased, no matter how extensive the œdema. Nephritis does occur in infants, and occurs particularly often in syphilitic babies. The autopsies in these cases show microscopic changes, and often the macroscopic appearance denotes inflammation; frequently, however, the eye sees no changes, while the microscope may reveal both parenchymatous and interstitial disease. As interstitial nephritis occurs in conditions other than congenital syphilis, the question arises, Is a

cirrhotic kidney a syphilitic manifestation, or can a cirrhotic kidney be produced by intestinal toxins?

Heart Complications of Scarlet Fever.—I. H. EDDY (*Amer. Jour. of Obst.*, 1907, lvi, 493) states that he is convinced that the heart has not received the attention it should in the study of the complications of scarlet fever, especially as compared with the kidney. Among 225 deaths from the disease, which he investigated, he found that 130 had various complications; 40 had diphtheria. Simple endocarditis was reported 3 times, ulcerative endocarditis once, acute dilatation three times, dilatation and hypertrophy once, other heart complications thrice. It is not stated how many of these cases had a myocardial affection, but as this is especially to be dreaded in diphtheria, and in scarlet fever also, it is certain that this has been overlooked. The factors which are most likely to produce heart complications are exertion, persistent vomiting, toxemia of complications, rapidly developing anemia, and the action of toxins. Eddy states that the myocardial disturbance is frequently the cause of the nephritis; its low tension leads to passive congestion, which with the aid of the toxins produces the nephritis. The symptoms heralding the approach of a cardiac disturbance are sensation of impending danger, sudden pallor, and at times cyanosis, precordial pain, sudden change from a regular to an irregular pulse, from good tension to almost imperceptible tension, exacerbation of temperature, murmurs, etc. The prevention and treatment are summed up thus: (1) Rest in bed for three weeks as soon as the diagnosis is made, even though the attack is slight. (2) Liquid diet and plenty of water. (3) Antipyretics should not be used; the cold sponge or pack should be employed to reduce the temperature. (4) The oral cavity should receive special attention; toxins are constantly produced there, and adenitis or otitis media may be prevented. (5) The skin should be kept soft and active by baths, carbolated lanolin, etc. (6) The bowels should be kept open by calomel, salines, and colonic flushing. (3) Mild diuretics should be employed. (8) If vomiting persists, all medication should be discontinued for a time.

The treatment includes the following measures: (1) Absolute rest without a pillow. (2) Good ventilation, but no draughts. (3) A good nurse. (4) Diet rich in albuminous foods, as far as the kidneys will permit. (5) Eliminative treatment as given under prevention. (6) The patient should not be allowed to rise up or turn on the left side. (7) For nervousness or restlessness, small or large doses of morphine as the case demands; it is stimulating to the heart. (8) Stimulants under careful and constant supervision. (9) Strychnine is best and should be given in every case. (10) Alcoholic stimulants in doses of ½ dram to ½ ounce. (11) Camphorated oil in emergencies. The nurse should have it ready always, and should be relied upon to know when to give it. (12) Digitalis should not be ordered except when the pulse is very rapid and the tension very low. (13) The icebag should be kept over the heart. (14) The pulse and murmur should determine the time for the patient to get up. (15) The anemia should be treated with peptonate of iron and arsenic.

The Diagnosis and Treatment of Diphtheria in Young Children.—In young children the mortality from diphtheria is still very high and has not been reduced proportionately to that of older children since antitoxin has been introduced. SAVAGE and GOODALE (*Boston Medical and Surgical Journal*, 1907, clvii, 698) state that diagnosis by smears is unreliable, being of value only if positive; culture examination is absolutely reliable, but has one fallacy aside from the possibility of error: it takes at least twelve hours before a diagnosis is made. Clinically we can usually recognize a probable case of diphtheria, and mistakes are rarely made; if we wait for the culture report, we have diagnosis security, but the child has less chance of recovery. If suspicious cases are treated as diphtheria, the mortality will be much lower, especially as diphtheria antitoxin is harmless and may be beneficial to patients with tonsillitis, scarlet fever, etc. Very young children rarely have follicular tonsillitis, and therefore a probable diagnosis of diphtheria should be made upon slight evidence; the dangers of waiting are so great that a clinical diagnosis is of first importance and all sufficient for the purpose of treatment. Cultures are of value mostly for the purposes of immunization and quarantine. Concentrated antitoxin should be used, and the initial dose should be 3000 to 4000 units. The dose should be governed by the severity and duration of the infection, and not by the age of the patient.

OBSTETRICS

UNDER THE CHARGE OF

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Alterations in the Umbilical Cord Produced by Syphilis.—LIVON (*Ann. de Gyn.*, July, 1907) reports the results of his study of the umbilical cord in cases of fœtal syphilis. He examined the umbilical cord and, whenever possible, the umbilical vein at its entrance into the abdomen. In most cases the alterations were physical in character, inflammatory in nature, attacking the internal coat of the artery. There was proliferation of the connective tissue, with exudate and infiltration with leukocytes. These processes extended in greater or less degree throughout all the tissues of the cord. In many cords endarteritis and endophlebitis with stenosis and partial obliteration of the vessel had developed. A pathological process around the vessels was comparatively rare.

Depression of the Parietal Bone in a Newly Born Infant Relieved by Trephining.—NEWTON (*Brit. Med. Jour.*, August 10, 1907) describes the case of an infant born in breech presentation with the arms extended over the head. The patient was delivered by the nurse, who extracted the right arm, but a strong pain suddenly expelled the child before the left arm could be brought down.

On examination there was a large depression over the left parietal bone, extending several inches toward the occipitotemporal junction. The anterior fontanelle was almost obliterated and the bones could not be reduced by manipulation. During the next ten days no change occurred and operation was decided upon. The infant was fretful, but there were no signs of paralysis. Under chloroform anesthesia a horseshoe-shaped incision was made around the depression, with the base toward the temporal bone down to the periosteum. This flap was turned downward, a crucial incision was made through the periosteum behind the line of the meningeal artery, and four flaps were reflected. The bone was severed with a trephine, leaving a small bridge at the upper part, where the inner table was left. By reflecting the disc of bone the dura mater with a blood clot upon it came into view. The blood clot was adherent, but as much as possible of it was removed. The bone could not be elevated with a blunt hook without dangerous manipulation; accordingly, the tissues were replaced, the periosteal flaps stitched together, and the skin flap closed. The child was collapsed, but revived by warm saline injection and one-hundredth grain of strychnine hypodermically.

On the fourth day after the operation the dressings had become displaced and were removed, when the wound was found healed. The depression in the parietal bone had disappeared completely, and the anterior fontanelle was normal in size and shape. Stitches were removed on the eighth day, when a callus was found over the disc, which was quite firm. The child made a good recovery.

Chorio-epithelioma Outside the Uterus and Primary Embolic Chorio-epithelioma of the Vagina.—Hicks (*Jour. Obst. and Gynec. Brit. Emp.*, August, 1907) has collected 14 cases of primary chorio-epithelioma of the vagina, in 2 of which the patient died. Secondary growths were found in the lungs, kidneys, and liver, but the uterus escaped. The other 12 patients survived in good condition. The nodules were removed in all cases and a full microscopic description leaves no doubt concerning the diagnosis. Cases are also reported in which the vaginal growth did not appear until three or four years had passed after the expulsion of a blighted ovum. In the patients who recovered the nodules of the vagina had been completely excised.

Hicks also reports the case of a multipara who had pneumonia and who began to have hemorrhage from the uterus. On examination the cervix was dilated and a large hydatid mole, with a five and a half inch dead fœtus, was removed from the uterus. The uterine cavity was found smooth and soft. Pelvic inflammation did not develop, the uterus remained soft and bulky, and there was a blood-stained discharge of dark color. The patient had fever with subinvolution. In the upper portion of the left side of the vagina a cyst developed as large as a small orange, and in the lower portion on the posterior wall a small nodule. This nodule was removed under an anesthetic and twelve days afterward it was found that the cyst had disappeared spontaneously. The uterus had become normal in size, hemorrhage had ceased, and the patient's general condition was very good. There was no vaginal discharge. The patient has remained well. Examina-

tion of the nodule showed Langhan's cells in abundance, with syncytial tissue. Villi were absent, but there was much necrosis and hemorrhage around the masses of cells. The structure was typical of chorio-epithelioma.

Some time later the patient was again examined, when a small, soft, but well-defined tumor was discovered in the lower portion of the anterior vaginal wall. This was near the urethra, and in removing it it was necessary to separate the urethra as high as the base of the bladder Tumors continued to appear in the vagina, increasing rapidly in size. The patient finally died with anemia and hemorrhage eleven months after the expulsion of the mole. On examination secondary deposits were found in the right lung. The tissues of the vagina were also infiltrated with the growth.

From the study of this and other reported cases it seems that vaginal chorio-epithelioma often follows the expulsion of a vesicular mole, but may occur after abortion or full-term pregnancy.

Such growths may also occur while the mole is still in the uterine cavity. They originate from the epithelium of embolic villi, and there is no evidence to show that a malignant growth or mole can be expelled from the uterine body, leaving that organ free from growth, while metastatic deposits may occur elsewhere in the body. The growth spreads by the perivaginal veins, and it is impossible to tell whether a given specimen will prove malignant. The presence of a large quantity of syncytial tissue is characteristic of vaginal chorio-epithelioma.

Chorio-epithelioma Complicated by Hematometra.—GRIFFITH and WILLIAMSON (*Jour. Obst. and Gynec. Brit. Emp.*, August, 1907) report the case of a multipara who had during pregnancy a blood-stained vaginal discharge with aching pain over the pelvis. Amenorrhœa had persisted for six months; the top of the uterus was but six inches above the pubes. As the uterus did not increase in size, a month later a tent was introduced, followed shortly after by the expulsion of a mole. The uterus remained large, with more or less hemorrhage, which finally ceased.

A diagnosis of chorio-epithelioma was made and abdominal hysterectomy was performed. The uterus was involved and the ovaries were enlarged by multiple cysts of a dark color. The uterus and appendages were removed. When the uterus was opened it was found that the cervical canal was occluded by coagulated blood. Hemorrhage had been prevented by this clot, and blood had accumulated in the uterus, distending its cavity. This accounted for the puzzling feature in the case, namely, the rapid increase in the size of the uterus, accompanied by complete cessation of vaginal hemorrhage. The patient subsequently died from metastases to the lung. Examination of the tumor showed it to be typical of chorio-epithelioma.

Labor Complicated by Calcareous Fibromyoma of the Right Ovary.—CONWAY (*Jour. Obst. and Gynec. Brit. Emp.*, August, 1907) reports an interesting case of a primipara who was admitted to the hospital with a lower limb of the fœtus protruding from the vulva. The history stated that the patient had been in labor for some days and that her physician

had urged her to go to the hospital because of a tumor in the pelvis which made delivery impossible. The patient had declined to go until the fœtal limb appeared. On admission the patient was having strong pains and on examination a hard mass the size of a fœtal head almost completely filled the pelvis. Under anesthesia it was finally possible to push up the tumor and deliver the child. It had been dead for some time. Some weeks after labor the patient returned to the hospital for operation, when a calcareous fibromyoma of the right ovary was removed without difficulty. The patient made a complete recovery.

GYNECOLOGY.

UNDER THE CHARGE OF

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Sarcoma of the Ovary during Pregnancy.—E. BIRCHER (*Zentrbl. f. Gynäk.*, 1907, xxxi, 1378) says that sarcoma of the ovary is of rare occurrence. The literature shows only a very few cases in which a fibrosarcoma was found during pregnancy. Carcinoma is much more common. The greater number of ovarian sarcomas are of the spindle-cell type. The author makes a detailed report of a case in which a rapidly growing fibrosarcoma of the ovary was removed during the fourth month of pregnancy. There was no recurrence of the disease at the end of three years.

The Surgical Treatment of Inflammatory Diseases of the Appendages.—GILES (*Brit. Jour. Gyn.*, January, 1907, suppl. to vol. xxii, 93) reports a series of 120 cases, as follows: Non-suppurative conditions, 46; deaths, 3; suppurative conditions, 74; deaths, 4. Of the non-suppurative cases, 11 out of 46 were unilateral, and in 3 of the 11 the other appendage had been removed at a former operation. This practically reduces the unilateral involvement in this series to 8 of 46 (17 per cent.). The mortality in the 46 cases was 6.5 per cent. This fact might well give rise to the question of the advisability of ving behind an appendage having a normal or nearly normal appearance when one appendage is removed, when a mortality rate of 6½ per cent. accompanies such operations. Three of the 14 cases were thus subjected, which means that that small number were subjected to the risk of double the mortality, 13 per cent., by being subjected to two operations. It is true that in the non-suppurative class all 3 deaths were in the bilateral cases, 32 in number, a very high mortality rate for non-suppurative cases, yet little comfort can here be found for the unilateral operation. In the suppurative cases 12 were unilateral, with 2 deaths, and 62 bilateral, with 2 deaths. It thus appears that the mortality rate in double suppurative cases (2 in 62), 3.5 per cent., was just twice as good as in the bilateral non-suppu-

rative cases. The large proportion, about 84 per cent., of bilateral suppurative cases also seems to prove the inadvisability of the so-called conservative operations. It is interesting to note that 5 of the 12 unilateral suppurative cases were postpuerperal. This type of puerperal infection is practically always due to the gonococcus, and, as gonococcal adnexal suppuration is practically always double, it would seem as if the unilateral operations for suppurative disease could almost be eliminated. While many surgeons, who have done thousands of operations for adnexal disease, would consider 120 cases as too small a number from which to draw conclusions, yet in chronic conditions Giles' conclusions are fairly sound, judged from the consensus of opinion of the age; but his dread of vaignal incision is at wide variance with the results of great experience and advanced thought.

Cystoscopic Findings in Cases of Vesicovaginal Fistula Healed by Operation.—W. HANNES (*Zentrbl. f. Gynäk.*, 1907, xxxi, 1372) made cystoscopic examinations of 8 patients previously operated upon for vesicovaginal fistula by the method of Kustner, in which the anterior cervical wall is utilized in closing the fistulous opening. In 3 cases no scar was observed. In all other cases there was a flat, more or less broad or radiating, and intensely white scar in the mucous membrane, which had the appearance of having been formed by granulation rather than by healing by first intention. In 4 instances a diverticulum was observed in the region of the scar. Several cases are cited to show that this method of closing a vesicovavinal fistula is not incompatible with a subsequent pregnancy.

Formation of an Artificial Vagina by Intestinal Transplantation.—JAMES F. BALDWIN (*Amer. Jour. Obst.*, 1907, lvi, 636) employed this procedure March 22, 1907, on a woman aged thirty-eight years, who had eight months previously been delivered by forceps of her first child. Following delivery complete sloughing of all the vaginal tissues occurred, leaving a sinus so small that passing a probe along it was impossible. The plan followed was to open the abdomen and remove diseased Fallopian tubes. The cul-de-sac was then opened and the vaginal sinus gradually and broadly dilated from above. A loop of the lower end of the ileum was seized with forceps introduced through the vagina, and, having been detached from the rest of the bowel, was drawn down into the new canal, the continuity of the intestine having been restored with a Murphy button. The uterus being quite immobile, rendering suture of the cervix to the intestinal loop impossible, and the reproductive function of the uterus destroyed, this organ was removed. The peritoneum was drawn over the floor of the pelvis. May 1, the septum between the two vaginas was cut with scissors and light packing introduced. August 18, the vagina seemed to be practically normal and showed no evidence of being artificial.

Cystocele.—C. P. NOBLE (*Jour. Amer. Med. Assoc.*, 1907, xlix, 1982) regards cystocele as a hernia of the bladder into or through the vaginal opening, and as a part of a complex condition consisting of a laceration of the sacral segment of the pelvic floor (perineum), with prolapse of

the anterior and posterior vaginal walls and of the uterus. It is Noble's opinion that the tonic condition of the abdominal muscles, intra-abdominal pressure, the proper anatomical supporting ligaments of the uterus and of the bladder, each plays its role in the maintenance of the position of the pelvic orgas, but the greatest factor is the integrity of the sacral segment of the pelvic floor. The exceptions are in cases of marked muscular relaxation of the pelvic tissues, of absorption of the perivaginal fat, of exaggerated intra-abdominal pressure, or a combination of two or three of these factors. Following the suggestion of Hadra, of Texas, that any successful operation for cystocele must be based upon the essential of incising the anterior vaginal wall and separating the bladder from the cervix and vagina sufficiently to permit it to rise in the pelvis, then to resect the anterior vaginal wall to get rid of the excess of tissue, and by following this by suturing the anterior vaginal wall to the anterior face of the cervix, the technique of Noble's method of procedure is as follows: After the uterus has been curetted and the cervix amputated, if necessary, the cervix is drawn down by a volsellum forceps and another volsellum forceps is attached to the anterior vaginal wall near the internal orifice of the urethra. Traction is made on these two forceps and the anterior vaginal wall between them is incised. The tissue on each side of the incision is seized by a forceps for traction purposes and the bladder is separated from the anterior surface of the uterus to above the internal os and from the vagina bilaterally sufficient to permit the bladder to ascend into the peritoneal cavity. The redundant vagina is sparingly excised. The excised portion is oval, with the broader end nearer the uterus. Two rows of buried half-hitch continuous sutures are now inserted, the first embracing the deeper layers of the vagina and catching lightly the bladder wall for the first inch of the incision, and then suturing the deeper layers of the vagina to the anterior surface of the cervix. This is followed by a superficial row. Two or more mattress sutures of chromocized catgut are placed to lessen the strain upon the continuous sutures.

A Simplified Cystocele Operation.—D. Tod Gilliam (*Jour. Amer. Med. Assoc.*, 1907, xlix, 1984) describes his method as consisting of: (1) An oval denudation of the most prominent part of the cystocele, as in the old time operation. (2) Dissecting flaps from the vaginal wall on the sides of the denuded area with which to cover it. (3) Bringing the flaps together over the denuded area and suturing them to it and to each other. The result is: (*a*) The cystocele is effaced. (*b*) The site of the cystocele is strengthened by an additional layer of fascia: that taken from the sides. The technique is as follows:

The redundant tissues along the median line of the anterior vaginal wall are gathered and the line of incision marked out. The crest of the cystocele is grasped by a tissue forceps and a tenaculum is applied above and below the tissue forceps to straighten out the various little folds on either side of the main fold. The main longitudinal fold represents the area to be denuded, and is marked off by pulling it to one side and lightly drawing the knife along its base over the median line from within a half inch of the upper end of the fold to a like distance from the other end. The redundant tissues are now lifted up and by means

of the tenacula are gathered into a longitudinal fold along the median line of the anterior vaginal wall. An incision is now made along one side of and at the base of the fold at or near the median line, and extends each way to from one-half inch each end of the fold. Next carry the incision down through the fascia to the vesical muscularis, a similar incision being made on the other side of the fold. By blunt dissection the bladder is separated from the vaginal wall from the incision out to the sulci. The two separate layers of the vaginal wall are converted into flaps by cutting outward from the upper and lower extremities of the incisions toward the sulci. Denude the area between the incisions, but do not remove the fascia, and draw the flaps over the denuded area and suture them to it and to each other from below upward. It is now pulled in the opposite direction and marked in like manner. These lines also mark the internal boundaries of the lateral flaps. These shallow incisions are now deepened to extend through the fascia to the muscularis of the bladder. The bladder by blunt dissection is separated, from the vagina to the sulci and as far as both ends of the incision. The flaps are made by cross cuts from the ends of the incision toward the sulci. The central area is denuded and the flaps drawn over it and sutured to it and to each other. Interrupted sutures are used.

DISEASES OF THE LARYNX AND CONTIGUOUS STRUCTURES.

UNDER THE CHARGE OF

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Pelliculous Sore Throat.—HOLMES (*Lancet-Clinic*, September 7, 1907) reports a fatal case of cryptogenic staphylococcic bacteremia in a child, aged nine and one-half years, beginning as a pelliculous sore throat which was presumed to be diphtheritic, although not verified by bacteriological examination, and which had been treated with a series of large injections of antitoxin.

Concretion in the Lymphoid Mass at the Vault of the Pharynx.—MORROWAY (*Jour. Amer. Med. Assoc.*, September 28, 1907) reports the spontaneous expulsion of a concretion resembling a rhinolith from an hypertrophied Luschka's tonsil in a man, aged twenty-eight years, with atrophic rhinitis, and presenting symptoms apparently identical with those of hay fever.

Foreign Body in the Œsophagus Mistaken for Carcinoma.—MOURE (*Annales des maladies de l'oreille, du larynx, du nez, et du pharynx*, July, 1907) relates the case of a man supposed to be dying of inanition under

the diagnosis of carcinoma of the œsophagus. Œsophagoscopy revealed an arrested mass of meat completely occluding the œsophagus. This he removed, and the patient recovered rapidly.

Primary Nasal Tuberculosis.—THRASHER (*Lancet-Clinic*, August 17, 1907) reports an additional case with illustrations of microscopic findings. All diseased tissue was removed with the cold-wire snare, cutting forceps, and curette; and the cut surfaces were cauterized with lactic and trichloracetic acid. At the last examination the parts were perfectly free from tuberculous granulations, and the general health of the patient was excellent.

Ozena.—PEREZ (*Annales des maladies de l'oreille, du larynx, du nez, et du pharynx*, June, 1907) contends that every case of ozena or specific and contagious rhinosinusitis, is developed from another case of ozena or else from the muzzle of a dog; and he supports his views with a summary of 180 cases.

Laryngeal Papillomas in Infants Removed under Direct Inspection.—VAN DEN WILDENBERG (*Annales des maladies de l'oreille, du larynx, du nez, et du pharynx*, August, 1907) reports two cases of infants, aged seventeen and eighteen months, respectively, from whom he removed papillomas by direct laryngoscopy. A spasm of asphyxia occurring during the removal of a neoplasm in one of these cases rendered immediate tracheotomy necessary, after which the remaining growths were easily removed a few days later.

Paralysis of the Recurrent Nerve in Tuberculosis.—FALLAS (*Annales des maladies de l'oreille, du larynx, du nez, et du pharynx*, August, 1907) reports three cases of paralysis of the recurrent nerve in which radioscopy revealed infiltration of the apices of the lungs, in two cases accompanied by enlargement of the mediastinal glands. In one of these cases, a paralysis of the left side, a severe spasm of dyspnœa necessitated immediate tracheotomy.

Hypertrophy of the Pharyngeal Extremities of the Eustachian Tubes.—DOELAN (*Jour. of Laryng., Rhin., and Otol.*, June, 1907) gives an analysis of 14 cases. In all of them the hypertrophy was so marked as barely to allow the finger to pass between the swellings. 10 of them had been sent to a hospital for operation for adenoids by medical men accustomed to recognize the signs of rhinopharyngeal obstruction, but in 4 cases only were there a few small adenoids, and in the rest none.

Tumors of the Pharynx Due to Aneurysms of the Internal Carotid Artery.—TEXIER (*Revue hebdomadaire de laryngologie, d'otologie, et de rhinologie*, October 12, 1907) adds 2 cases to the 10 he was able to collect in literature. The tumors presented the appearance and consistence of abscess for which, indeed, the first one was mistaken. Digital exploration revealed a pear-shaped contour of the tumor with point downward, but no pulsations were revealed. In the first case, a woman aged seventy-four years, an exploratory puncture revealed the nature of the contents, and the trocar was immediately removed without subse-

quent hemorrhage, but the tumor enlarged in volume about one-fifth and so remained for two days. On the third day bulbar symptoms supervened followed by coma, and death by syncope ensued two days later. Autopsy revealed the aneurysmal pouch in the tract of the internal carotid about the size of a large hen's egg, with its greater extremity upward. The second patient, a woman, aged forty-seven years, had a growth about the same size and contour, and without pulsation; but with a long metallic stethoscope an aneurysmal murmur could be distinguished synchronous with the first sound of the heart, and a murmur could also be distinguished on the corresponding part of the outside of the neck. This patient was placed upon iodide of potassium with a reservation as to the necessity of ligating the carotid.

Tuberculous Stenosis of the Larynx.—DUPOND (*Revue hebdomadaire de laryngologie, d'otologie, et du rhinologie,* August, 31, 1907) reports a case of chronic pulmonary tuberculosis with laryngeal involvement in which, toward the end of life, a double crico-arytenoid arthritis developed with immobilization of both vocal bands. Tracheotomy rendered respiration comfortable until death from gangrenous destruction of tuberculous lesions at the summit of the lungs a little more than a month later.

Stuttering.—BOISVEIL (*Jour. of Laryng., Rhin., and Otol.,* September, 1907) reports a case of stuttering which disappeared for a few months after each of three successive operations for removal of tonsils and lymphoid growths of the pharynx, and which disappeared completely after section of the uvula without anesthesia.

CASTEX reported two severe cases of stuttering which had disappeared on removal of lymphoid growths. On the other hand, he had seen a patient acquire temporary stuttering after an operation of this kind.

Nasal Cough.—In a dissertation on nasal cough LERMOYEZ (*Annales des maladies de l'orielle, du larynx, du nez, et du pharynx,* September, 1907) reports a case of severe obstinate cough of eleven years' duration, which had resisted treatments addressed to the throat and to the nervous system, as well as to a supposed rheumatic diathesis, without effect. Although nasal respiration was unimpeded and topical contact of instruments to different points of the nasal mucous membrane and other portions of the aërial tract failed to provoke paroxysm, the cough was immediately and permanently stopped by the evulsion of a few small pedunculated polypi from the left middle turbinate bone.

HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF

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Plague and Fleas.—The Plague Commission (*Journal of Hygiene*, September, 1906) has made a report on its experiments upon the transmission of plague by fleas, which establish the correctness of the assertion that the common Indian rat flea, *Pulex cheopis*, plays a part in its dissemination. They placed a plague-infected rat and a number of fleas in a cage enclosed with muslin, and after the death of the rat a healthy rat was introduced into an adjoining cage to which the fleas could gain access. In 11 of 16 experiments with non-immune white rats, and in 19 of 50 with partly immune black or gray rats, the second rat developed the disease. Fleas transferred from rats that had died of plague to healthy rats produced the disease in 21 out of 38 experiments. In the absence of fleas the association of plague-infected animals with healthy ones resulted negatively, but if fleas were present the disease was spread. Examination of fleas (*Pulex cheopis*) having access to plague-infected animals showed an abundance of the bacilli in their stomachs. This flea attacks man as well as rats. They found that the urine of infected rats contained but few bacilli and that the feces are not highly infective; but their blood was found usually to contain enormous numbers, even 100,000,000 per c.c.

The Commission's additional reports (*Journal of Hygiene*, extra number, July, 1907) are of even greater interest than the former. Their studies on the transmission of plague by fleas led to the following sets of conclusions concerning the fate of the plague bacillus in the body of the Indian rat flea (p. 419): (1) The average capactiy of a rat flea's stomach is approximately 0.5 c.mm. On this basis a flea imbibing the blood of a plague rat showing a good septicemia might take as many as 5000 germs into its stomach. (2) Multiplication of the plague bacillus takes place in the stomach of the rat flea. (3) The approximate proportion of fleas in the stomach of which multiplication of plague bacilli takes place has been determined, and it has been shown that this proportion varies with the season of the year, being six times greater in the epidemic season than in the non-epidemic season. (4) Plague bacilli are present in the rectum and feces of fleas taken from plague rats, and such feces are infective to guinea-pigs both by cutaneous and by subcutaneous inoculation. (5) On rare occasions plague bacilli have been found in the œsophagus, but never in any other region of the body, such as the body cavity or salivary glands. (6) During the plague season fleas might remain infective for fifteen days after imbibing infected blood, but during the non-epidemic season no animal was infective after the seventh day. (7) A single rat flea may transmit the disease. (8) Both male and female rat fleas can transmit the infection.

(9) Experimenting with cat fleas (*P. felis*) and human fleas (*P. irritans*), 27 experiments with the former were unsuccessful, and out of 37 experiments with the latter three successes were obtained. Two experiments were made with *C. fasciatus;* both were successful. Multiplication of the plague bacillus takes place in the stomach of the human flea. (10) The plague bacillus has never been seen in the body cavity or in the salivary glands of infected fleas.

Evidence has been obtained to show that the bite of a healthy flea affords a sufficient avenue for infection by septicemic blood if it is spread upon the bitten part. No evidence has been obtained in favor of infection by contaminated mouth parts or regurgitation from the stomach, but the possibility of infection by such means cannot be excluded.

Other experimental studies led to these conclusions (p. 435): (1) Close and continuous contact of plague-infected animals with healthy animals, if fleas are excluded, does not give rise to an epizootic among the latter. As the godowns were never cleaned out, close contact includes contact with feces and urine, and eating of food contaminated with feces and urine of infected animals. (2) When fleas are present, the epizootic, if it does not start, varies in severity and rate of progress according to the season of the year and the number of fleas present. The season in which epizootics were readily produced experimentally, and spread rapidly, corresponds with that of the plague epidemic. (3) An epizootic of plague may occur in a godown containing infected fleas without direct contact of healthy animals and infected animals (Experiments III, IV, V, and VI). (4) In an infected godown the infection is effective in proportion as the test animals are accessible to fleas. (5) Infection can take place without any contact with contaminated soil (Experiments IX to XIV). (6) The experiments exclude aërial infection. (7) The experiments lead to the conclusion that fleas and fleas alone, were the transmitting agents of infection.

Experiments in plague houses in Bombay yielded the following (p. 445): (1) In 19 out of 100 experiments guinea-pigs allowed to run free in houses which were presumably plague infected developed the disease and died. (2) On three occasions, namely, on every occasion of which the experiment was made, fleas transferred from plague-infected rats found in houses infected fresh guinea-pigs in the laboratory. (3) Rat fleas, caught on guinea-pigs in plague houses and transferred to fresh guinea-pigs, transmitted the disease in 35 per cent. of the cases. (4) A census of rat fleas in houses in Bombay, which were proved plague infected, indicated that rat fleas were twelve times as numerous as in control houses; and that in presumably infected houses rat fleas were four times as numerous as in control houses. (5) In 41 out of 130 fleas taken on guinea-pigs in plague-infected houses, bacilli microscopically indistinguishable from plague were found in the stomach. (6) In the case of 24 of the 27 houses definitely proved to be plague infected, dead rats had been found shortly before the experiments were made.

Concerning man as a host of the Indian rat flea the following facts are given (p. 475): We have shown that in the laboratory the rat flea, *P. cheopis*, will readily bite man. When very numerous it will bite man even in the presence of its natural host. We have been able to

keep this species of flea alive for more than three weeks by feeding it on man alone. In the course of some experiments in godowns which were infested with *P. cheopis* alone, we have often taken fleas in considerable numbers on the legs of men who have entered the godowns for a short time. In a building in Bombay, in which there had been a severe rat mortality, proved to be due to plague, we have taken rat fleas in large numbers on the legs of men who entered some of the rooms in this building even for a short time. We can conclude, therefore, that the rat flea, *P. cheopis*, under certain circumstances, is attracted by man, and will readily bite and feed on him.

Sewage Bacteria in the Air.—Experiments conducted by MAJOR W. H. HORROCKS, M.D. (*Journal of the Royal Sanitary Institute*, May, 1907, p. 176), to determine whether specific bacteria are ejected into the air by the bursting of bubbles at the surface of sewage showed that, independently of air currents, bacteria will not be ejected thereby to a height of four inches; but with the aid of air currents they may be carried vertically as much as nine feet. Experiments to determine whether bacteria dried on the inner surfaces of (vertical) pipes can be detached by air set in motion through them by sewage flowing through horizontal pipes with which they are joined at their lower ends, yielded positive results. Another series of experiments to determine whether specific bactera are ejected into the air of drain pipes and sewers from sewage flowing under normal conditions seemed to prove a vertical movement of at least eleven and three-quarter feet.

Typhoid Carriers.—On account of the fact that typhoid convalescents may, for a long time, continue to discharge the specific bacilli in their feces and thus act as foci of infection, DRS. SIMON and DENNEMARK (*Deut. milit. Zeit.*, 1907, Nr. 3, p. 86) recommend that, before such persons be detailed to army kitchens, they be subjected to examination at intervals of three days and until five consecutive examinations yield negative results, since otherwise they may, through contact infection, cause explosive outbreaks of the disease.

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